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Soil Survey
of
Franklin County, Massachusetts

By

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and
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Bureau of Chemistry and Soils

In cooperation with the
Massachusetts Department of Agriculture

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SOIL SURVEY OF FRANKLIN COUNTY, MASS.

By W. J. LATIMER, in Charge, and L. R. SMITH, United States Department of Agriculture, and CAREY HOWLETT, Massachusetts Department of Agriculture

COUNTY SURVEYED

Franklin County is in the northwestern part of Massachusetts, bordering the Vermont and New Hampshire State lines. (Fig. 1.) The center of the county is about 100 miles west of Boston and the same distance east of Albany, N. Y. The east and west dimension is 40 miles, and the greatest width from north to south is 22½ miles. The county covers an area of 691 square miles, or 442,240 acres.

The upland plateau of southern New England is crossed in a north-south direction in western Massachusetts and Connecticut by the broad Connecticut Valley lowland belt. Franklin County stretches across this lowland, the western part of the county lying on the plateau west of the lowland, the eastern part on the plateau east of the lowland, and the central part lying across the lowland.

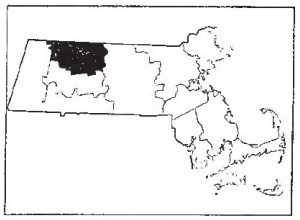

FIGURE 1.—Sketch map showing location of Franklin County, Mass.

The plateau slopes southeastward. The western part of the county lies at an elevation of about 2,000 feet above sea level, and the eastern end, lying on the lower part of the plateau east of the Connecticut River lowland, is about 1,200 feet above sea level. The Connecticut Valley lowland is uneven and has a rather wide range in the elevation of its various parts, but it lies more than 1,000 feet lower than the plateau in the western part of the county. The plateaus in both parts of the county and the lowland have been dissected and further modified in their relief by glaciation.

West of the lowland a severely dissected region of low hills extends back from the valley for several miles, the hills rising to about the same level as the eastern upland and finally merging with the western plateau, with its somewhat flattened ridge tops and narrow V-shaped valleys. The lowland, known as the Connecticut Valley,[1] includes the present flood plain of Connecticut River, the lower reaches of Deerfield and Green Rivers, and the remnants of an old terrace of Connecticut River, interspersed with low hills which are remnants of the old lowland now so thoroughly dissected that its remnants are mere irregular hills. The Connecticut River Valley has been carved out of this lowland throughout most of its course through Franklin County. The lowland is about 5 miles wide, extends almost to the northern county line, and is hemmed in by more or less steep slopes on both sides. The lowland, aside from the hills within its borders, is marked by three well-defined levels, 100 feet above sea level in the southern

[1] Connecticut Valley, hereafter referred to in this report as the valley, is the lowland belt occupied by Connecticut River and includes the glacial and river terraces, low upland, and the present flood plain. This valley, or lowland, is distinguished from the low terraces and the flood plain of Connecticut River by use of the term, Connecticut River Valley.

part, 200 feet in the central part, and 300 feet in the northern part. The surface of each level, representing a terrace, is fairly smooth, although there is a well-defined break between the different levels.

The entire county, with the exception of small areas, is well drained. Connecticut River, which flows in a general southwest direction through the area, and its main tributaries, Deerfield River entering from the west and Millers River from the east, constitute the trunk lines of the drainage system. Connecticut River enters the county at an elevation of 190 feet above sea level[2] and leaves at an elevation of 90 feet, the descent being effected mainly through two well-defined drops midway in its course across the county. Throughout the remainder of its course the gradient is low.

The general elevation of the western highland ranges from 1,500 to 2,000 feet above sea level, and the lowland lies from 800 to 1,200 feet below the general level of the plateau. The elevation is greater at a few places. Spruce Knob in the extreme northwestern corner, with an elevation of 2,800 feet, is the highest point in the county. The foothills are more irregular, ranging from 1,000 to 1,500 feet above sea level, and are largely cut into narrow ridges, small hills, and narrow valleys. Most of the eastern upland ranges from 1,000 to 1,200 feet in elevation, a few points reaching an elevation of 1,400 feet. Although the general slope is toward the southwest, the internal trend or slope is toward the main drainage stream and the principal lateral drainage streams, which form a cross.

The forest flora differs to some extent with the physiographic divisions. The forest of the eastern upland is mixed, consisting mainly of white pine, white oak, chestnut oak, chestnut, hard maple, soft maple, and gray birch. The forest growth in the lowland includes white pine, pitch pine, elm, sycamore, scrub oak, chestnut oak, red maple, and gray birch. In the foothills the dominant growth is oak, beech, white birch, hickory, ash, basswood, walnut, rock maple, and hemlock. On the western highlands the forest growth includes white birch, yellow birch, beech, rock maple, larch, and white pine and spruce at higher elevations. Hemlock and mountain-laurel grow in the gorges and ravines in all parts of the county. Much willow, red maple, alder, blueberry, and tamarack grow in swampy places and lowlands. Pastures contain such shrubs as steeple bush (*Spirea tomentosa*), ground juniper, cedar, sweetfern, and sumac. Much of the forest is sprout forest and has the characteristic growth of such vegetation, but in places the forest is open and contains little underbrush, especially the conifer forests, the hard maple groves, or the beech forests of the western highland and foothills.

The old field and pasture grasses belong mainly to the poa family, including Kentucky bluegrass, Canada bluegrass, spear grass, and wood bluegrass. Such grasses as broom sedge, Rhode Island bent, false redtop, poverty grass, quack grass, and witch grass, are also found. In wet places ground pine, club moss, and ferns abound.

Franklin County was formed in 1811 from a part of Hampshire County. The first settlements were made at Deerfield in 1677 by English colonists. The valley was the first section settled and later the settlers, largely English people from the older settled sections of Massachusetts and Connecticut, spread to the highlands. Nearly all

[2] Elevations from United States Geological Survey quadrangles covering this county.

the inhabitants, up to the middle of the last century, were descended from the original stock or from the inhabitants of adjacent New England territory. During and immediately following the railroad construction period many Irish settled in the county. During the last 20 or 30 years, a large number of Poles have settled in the farming sections of the Connecticut Valley and some Italians and French Canadians have come into the industrial towns. The trend of the population is toward the valley. This is the most thickly settled section; second, the foothills; third, the eastern upland; and fourth, the western highland which is the most sparsely settled section. The total population is reported as 49,612 in 1930, and the density of population is 71.2 persons a square mile.[3]

Greenfield, with a population of 15,500 in 1930, is the county seat and the most important town in that it is the trading center of the entire county. It is also an important manufacturing center. Montague, with 8,081 population, and Orange, with 5,365, are smaller but important industrial towns. Railroad transportation is effected through several railroad lines and an interurban line (electric) which connects the largest two towns. Bus lines operate to and from nearly all the towns. A number of surfaced State highways cross the county. The county maintains a system of improved roads which reach all parts, and even the secondary roads are in fair shape except during winter. Telephone service reaches all parts of the county, the school system is excellent, churches are in every community, nearly every town has a public library, and most of the towns have water and lighting systems.

A number of hydroelectric plants are in operation and furnish local and outside electric power. Manufacturing is fairly important and includes such commodities as paper, clothing, sewing machines, cutlery, tools, metal products, lumber, and wood products.

CLIMATE

The climate of Franklin County is humid. It is marked by long, cold winters, with much snow, and short comparatively warm summers, during which the rainfall is usually sufficient to insure crop production. Dry periods sometimes occur in the fall, after the crops have matured. The rainfall is usually heaviest in summer, but it is well distributed throughout the year. The climate in the highlands, particularly in the western highlands, differs greatly from that of the Connecticut Valley which holds the heat during the humid summer weather and acts as an oven, in which crops mature rapidly. The western highlands, on the other hand, are cool during most of the summer, and in the low spots on this higher land frost is not infrequent during the summer. Fogs are of common occurrence during the fall and spring.

Climatic conditions in the foothills and eastern uplands are intermediate between the extremes of the valley and the western highland. There is a difference of two weeks in the maturing of crops in the lowland and in the western highlands.

The Weather Bureau station at Turners Falls is more representative of the valley than of the highland. In the valley the time elapsing between the average date of the last killing frost and that of the

[3] Soil survey reports are dated as of the year in which the field work was completed. Later census figures are given whenever possible.

first is about five and one-half months, from April 27 to October 11. In the highlands the average length of the frost-free season is approximately four months. The growing season in the valley is ample for maturing all crops common to the North Temperate Zone, but in the western highlands only short-maturing crops can be safely grown. In the Connecticut Valley the early varieties of dent corn reach maturity for husking, but over the rest of the county only flint corn will mature, and on the higher parts of the western highland only small varieties of dent corn will mature (*1*).[4]

Table 1 gives the more important climatic data as recorded at the United States Weather Bureau station at Turners Falls.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Turners Falls, Mass.*

[Elevation, 200 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1894)	Total amount for the wettest year (1915)
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*
December	27.6	57	−24	3.19	3.18	6.34
January	23.3	57	−28	3.09	1.75	5.16
February	22.7	54	−22	2.78	1.72	4.65
Winter	24.5	57	−28	9.06	6.65	16.15
March	34.1	74	−5	3.52	1.30	.22
April	46.0	85	15	2.98	1.41	2.75
May	57.4	90	28	3.31	2.06	1.67
Spring	45.8	90	−5	9.81	4.77	4.64
June	66.0	95	36	3.26	2.37	2.24
July	71.2	104	44	3.54	1.39	8.84
August	69.1	97	40	3.77	.69	10.06
Summer	68.8	104	36	10.57	4.45	21.14
September	61.6	92	28	3.54	4.86	1.63
October	51.4	78	21	2.79	3.95	2.98
November	39.2	68	4	3.10	2.98	3.00
Fall	50.7	92	4	9.43	11.79	7.61
Year	47.4	104	−28	38.87	27.66	49.54

AGRICULTURE

The bottom lands and meadows of the Connecticut Valley in the vicinity of Deerfield were the first parts of the county occupied. Settlements spread from this nucleus to all parts of the county until 1880, when about 80 per cent of the land was in farms, with about 65 or 70 per cent improved land. Agriculture reached its highest development about the middle of the nineteenth century. The early form of agriculture consisted of the growing of grass (for hay and pasture), corn, wheat, oats, rye, barley, flax, vegetables, and fruits (mainly apples for home use), and the raising of cattle (to produce products for home use), sheep, hogs, and chickens.

[4] Italic numbers in parentheses refer to literature cited, p. 45.

Shortly after 1880 the decline in farming began, and in 1930 the area in farms had been reduced to 58.4 per cent of the total area of the county, and only a small percentage of this was in crops. This decline in crop acreage was caused by migration of the farmers to the West and by rapid development of industrial towns. The shift from the older form of agriculture progressed slowly as the local markets developed a demand for different commodities. The change involved the lessened amount of corn grown for grain and an increase in that grown for silage. There has been a decrease in the producton of small grains for feed, noticeably oats, and an increase in the use of small grains as cover crops. The acreage devoted to hay decreased from 58,000 in 1879 to 45,332 in 1929, and the acreage in potatoes decreased slightly during the same period. The production of other vegetables has increased slightly. Apple growing has shifted from home orchards to commercial orchards. The acreage in tobacco has nearly doubled since 1879. The number of beef cattle shows a marked decline during this period, but the number of dairy cattle has greatly increased. Very few sheep are raised.

Tobacco has been grown for a long time in the Connecticut Valley, but only during the last 30 years has the crop become really important. Cigar-wrapper leaf of excellent grade is produced. Shade[5] tobacco was introduced shortly before 1900, and the acreage devoted to this crop increased prior to 1920, but it has decreased since that time and shade tobacco is now grown on about the same acreage as it was prior to the World War. Sumatra leaf was first introduced but soon proved to be unsuited to prevailing climatic and soil conditions. A good grade of Havana Seed was then introduced and has proved successful. Most of the shade-grown tobacco is grown by companies, as the expense of growing tobacco under shade is rather high.

The acreage and yield of the more important farm crops, as reported by the 1930 census, are shown in Table 2.

TABLE 2.—*Acreage and yields of certain farm crops in Franklin County, Mass., in 1929*

Crop	Acres	Yield
		Bushels
Corn, total	4,253	
Harvested for grain	2,112	89,039
		Tons
Cut for silage	1,778	19,163
Cut for fodder	329	
Hogged or grazed off	34	
		Bushels
Oats threshed	25	825
Oats cut and fed unthreshed	99	
Rye threshed	34	456
Buckwheat threshed	9	173
		Tons
Hay crop, total	45,332	52,652
Timothy and timothy and clover mixed	20,348	37,650
Clover—red, alsike, and mammoth	370	605
Clover—crimson, Japan, and sweetclover	23	33
Alfalfa	411	837
Other tame grasses	14,128	12,525
Wild grasses	630	389
Small grains cut for hay	323	527
Legumes for hay	99	86
		Pounds
Tobacco	2,525	3,580,524
		Bushels
Potatoes	839	79,382

[5] The word "shade" is used to distinguish the tobacco grown under a cloth tent from the open-field tobacco.

Onions (dry) were introduced as a field crop about 1900, and the acreage has increased since that time. The 1930 census reported 2,750 acres of vegetables grown for market in 1929, with a total value of $621,361.

Table 3 gives the acreage and value of market-garden crops as reported in the 1930 census.

TABLE 3.—*Acreage and value of market-garden crops in Franklin County, Mass., in 1929*

Crop	Acres	Value	Crop	Acres	Value
Asparagus	53	$10,221	Lettuce	14	$4,580
Beans (snap or string)	37	5,673	Onions (dry)	1,646	458,866
Beets	3	632	Peas (green)	17	2,816
Cabbage	57	9,392	Spinach	10	2,834
Cantaloupes	7	1,752	Squash	16	2,365
Carrots	9	1,309	Tomatoes	35	8,258
Cauliflower	11	1,340	Turnips	5	733
Celery	12	5,587	Mixed vegetables	92	20,083
Corn, sweet	222	18,385			
Cucumbers	504	66,535	Total	2,750	621,361

According to the 1930 census, 1,615 farms reported the use of fertilizer in 1929 at a total expenditure of $454,892, or $281.67 a farm. Most of this was used on the valley farms for tobacco and onions. Ready-mixed commercial brands of fertilizer predominate over the home-mixed fertilizers. Much of the separate ingredients are applied without mixing. The most popular grades of commercial fertilizer are 7–4–7,[6] 6–8–12, and 6–6–14, for tobacco; 3–8–7 to 6–8–7 for onions; 3–10–6 to 4–8–4 for corn and general use; 8–6–6 for top-dressing; and 5–8–7 for all-round purposes. Cottonseed meal is the chief source of nitrogen, bone the source of phosphorus, and sulphate the source of potash. Commercial mixtures analyzing 5–3–5, 5–4–5, 5–8–7, and 4–8–5 lead in tonnage sold; and of the separate ingredients, superphosphate and nitrate of soda lead. The use of concentrated fertilizers is increasing.

Lime is not in general use outside the valley but is sometimes used when sod is turned. In the valley it is used to a small extent on tobacco, and heavy applications are made to onions and market-garden crops. It is applied at the rate of 1 or 2 tons an acre.

Manure on farms other than dairy farms is scarce and on many farms is not available. Where it can be obtained it is used on corn (silage), tobacco, and market-garden crops. Tobacco stalks and stems are used on tobacco land. On a large area of the upland, sod is turned occasionally and is the chief source of organic matter. In the valley where sod turning is not practiced, manure cover crops or organic fertilizers are depended on for soil enrichment.

In 1929, according to the census returns, $781,797 was expended for the hire of labor, an average of $484.08 a farm. Farm labor is plentiful in the tobacco and onion districts in the southern part of the Connecticut Valley, but it is scarce in other parts of the county and high priced in all parts. Much of the farm labor is performed by the farmer and his family. During the rush of planting or in the harvest season, extra labor is employed by the day on the tobacco, onion, and market-garden farms and in orchards. Labor on the

[6] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

dairy farms is permanent. Day wages range from $2 to $5, and $7 a day is paid for a plow team with hand. Monthly wages range from $35 with quarters to $75 without quarters.

The average size of farms in 1930 was 96.6 acres. This is a decrease caused largely by the splitting up of farms in the Connecticut Valley into smaller holdings or by renting land formerly operated by one farmer to several tenants. This practice offsets the increased size of farms in the upland, which was brought about by consolidation of two or more farms. Of the 2,695 farms in the county in 1930, 61.9 per cent are between 20 and 174 acres in size. Only 4 contain more than 1,000 acres. In the valley small farms predominate, but in the upland the farms are larger.

In 1930, 85.1 per cent of the farms were operated by the owners, 13.4 per cent by tenants, and 1.5 per cent by managers. There has been little change in this respect during the last 50 years. At present few farms are operated by tenants outside of the valley, but indications point to an increase of tenancy in the onion and tobacco districts. Cash tenants pay about 5 per cent of the value of the land as rental. Tobacco and onion land rents for $30 to $50 an acre. Tobacco land rental includes the use of curing sheds or barns, one shed 30 by 75 feet being supplied for every 2½ acres of tobacco land. Under the share system the terms vary to suit the contracting parties but are fairly well standardized. On tobacco farms the owner furnishes land, fertilizer, work animals, and half the seed; the renter does all hand work, harvesting, and sorting; and each receives half the proceeds from the sale of the crop. Where land is rented for growing onions, the land only is furnished, but this must be first-class onion land, well drained, level, and free from stone, gravel, rubbish, or crop refuse. The value of the valley land is determined by its adaptability to the production of high-quality cigar-wrapper tobacco. Even at high rentals, this land is rented and successfully used for onions and other intensively grown crops, as potatoes, asparagus, and market-garden vegetables. Other lands in the valley, not suited to these crops, rent for a much lower price. Mowing and pasture land rent for a comparatively low figure. Little or no land outside the valley is rented.

The equipment of the valley farms is much in advance of that on the foothill farms and this, in turn, is far in advance of the equipment on small highland farms. Most of the farms have buildings suited to the class of farming engaged in. The valley farms have tobacco sheds, the fruit farms have packing houses and full spraying equipment, and the dairy farms have adequate dairy barns, silos, and corn shredders. The tobacco farmers have planters and stringer horses or gather baskets for priming. The onion growers are equipped with wheel cultivators and graders. The best farms have trucks and tractors with a full equipment of tractor-drawn plows, harrows, and cultivators, also work animals, wagons, 2-horse plows, fertilizer and grain drills, manure spreaders, mowing machines, hayrakes, tedders, and loaders, potato diggers, weeders, drags, and rollers. The farms in the uplands do not require the expensive outlay that the intensively cultivated valley farms require. Most of the farms, even in the hill section, require mowing machines, hayrakes, manure spreaders, 2-horse plows, and an assortment of plows, cultivators, and harrows suited to stony land, in addition to hand implements and tools.

The work animals consist of draft, semidraft, and standard-bred horses. The cattle are mainly of dairy breeds, Holstein predominating. Very few beef cattle are raised. A few sheep are raised in the foothill section. Dual-purpose breeds are most common, and there are a few head of purebred mutton and wool breeds. Most farmers keep some hogs, mainly of the Duroc-Jersey breed. Chickens are kept in large numbers on most farms, Rhode Island Red and White Leghorn breeds predominating.

Table 4 gives the number of livestock on the farms of Franklin County in 1930, and the number of chickens and eggs produced in 1929, as reported by the census.

TABLE 4.—*Number of livestock on the farms of Franklin County, Mass., in 1930, and number of chickens and eggs produced in 1929*

Domestic animals	Number	Chickens and eggs	Number
Horses	3,011	Chickens (Apr. 1, 1930)	84,617
Mules	47	Eggs produced in 1929 (dozens)	731,344
Cattle	20,159	Eggs sold in 1929 do	501,511
Cows for milk production	10,245	Chickens raised in 1929	212,047
Swine	2,134	Chickens sold in 1929	97,192
Sheep	2,877		
Goats	48		

The total value of livestock on the farms of Franklin County in 1930, according to the United States census, is $1,916,114, which is divided as follows:

Horses and colts	$348,027
Mules and mule colts	5,264
Asses and burros	70
Cattle	1,396,743
Swine	32,000
Sheep and lambs	24,451
Goats and kids	368
Chickens	105,771
Bees	3,420

According to the 1930 census, 58.4 per cent, or 260,326 acres, of the total land area of the county is in farms. Of this, 63,801 acres are in crop land and 124,352 acres are in pasture. Of the pasture land, 65,152 acres are woodland pasture. Included with the farm land are 61,027 acres of woodland not used for pasture and 8,898 acres of other land.

Hay crops occupied 45,332 acres in 1929. About the same acreage is in open pasture. Orchards occupied 4,851 acres in 1929. Most of the orchard acreage is planted in apples. The total acreage in corn in 1929 was 4,253 acres, about half of which was in silage corn. Tobacco was planted on 2,525 acres, and about one-eighth of the tobacco is shade grown. Onions occupied 1,646 acres; potatoes, 839 acres; and other vegetables are grown on smaller acreages.

A comparison of the 1925 census figures from selected towns in different parts of the county (Table 5) shows the distribution of the crops and the amount expended for fertilizer.

TABLE 5.—*Acreage of crops and amount expended for fertilizer in 1924 in selected towns in Franklin County, Mass.*

Towns	All land in farms	Crop land	Open pasture	Hay	Corn	Tobacco	Onions	Potatoes	Miscellaneous vegetables	Apples	Amount expended for fertilizer
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Dollars*
Deerfield[1]	16,111	8,788	3,723	3,569	758	1,037	557	156	8	58	190,227
Colrain[2]	25,999	6,264	9,146	4,531	282	6	------	87	------	1,250	6,061
New Salem[3]	7,810	1,689	352	1,361	19	------	------	22	1	110	1,148
Hawley[4]	10,110	2,564	5,439	2,042	54	------	------	39	1	152	2,148

[1] In the Connecticut Valley.
[2] In the western foothills.
[3] In the eastern upland.
[4] In the western highland.

The towns of the valley produce practically all the tobacco and onions, much of the corn, and a fair proportion of the hay, potatoes, and vegetables produced in the county. The western foothills include large areas of open pasture, much mowing, some corn and potatoes, and the greater part of the orchards. The western highland includes a small area of crop land compared with that of open pasture, and a large proportion of the crop land is in mowing. In the eastern upland the same condition exists.

The hay crop, valued at approximately $2,000,000 in 1919, was the most valuable crop grown at that time, although it had about the lowest acre value of the crops grown. Tobacco and onions (dry) have an average annual value of $1,000,000 each, with a rather high acre value that varies greatly from season to season. Fruit is the next crop in importance. Its average yearly value is slightly in excess of $600,000, and the acre value is high. The crop values of potatoes, other vegetables, corn, and small grains range from $300,000 to $400,000 each, with vegetables ranking highest, potatoes next, corn third, and small grains only slightly in excess of hay which includes wild hay. These estimates are made for a period of years preceding the recent rapid decline in farm values.

The census figures for 1929 in the following tabulation show very clearly the changes that have taken place in recent years:

Cereals	$99,464
Other grains and seeds	1,440
Hay and forage	839,378
Vegetables (including potatoes)	769,280
Fruits and nuts	363,828
All other field crops (including tobacco)	1,533,725
Vegetables grown for home use (excluding potatoes)	151,666

The 1930 census reports the value of farm land and buildings in Franklin County as $16,541,010, of which $7,160,157 represents the value of the land. The average value of land and buildings for each of the 2,695 farms is $6,138. The average assessed acre value of land alone is $27.50, and of land and buildings is $63.54. Implements and machinery are valued at $1,571,323, an average of $583.05 for each farm.

The valley land, especially the onion and tobacco land, is the highest-priced land. The average "open" tobacco land sells at prices ranging from $125 to $250 an acre, and, where equipped for shade growing, tobacco land brings from $500 to $750 an acre.

The agricultural practices of the different sections of the county differ widely, and farm practices even in the same sections differ with

the type of farming. Over all the county, except in the valley, the standard rotation of New England is used. This consists of sod land turned and planted to corn, followed by timothy and clover. The grass is mowed for several years, or until it begins to fail, and then the rotation is repeated. Potatoes, vegetables, and other crops are usually grown on special patches. In the valley, where land is used for such crops as corn or grass, sod land is turned more often, and potatoes and vegetables are included in the rotation. On the land used for tobacco or onions, rotations followed in other parts of the county are not used. Tobacco follows tobacco, and onions follow onions, and, contrary to all theories of land improvement, this seems to give the best results. (*3, 4, 7.*)

When sod land is turned preparatory to beginning a rotation, it is usually limed with at least 1 ton of lime an acre, and the available manure is applied during the winter. A small-grain nurse crop of oats or rye is often planted with grass following corn, but on some farms the grass is seeded without a nurse crop. Timothy or redtop is used for seeding the hay crop, or a mixture of the two, with red clover sown the following spring. If permanent pasture is desired, Kentucky bluegrass or Rhode Island bent is seeded with the grass. When mowings reach the point where they are composed largely of weeds and grasses of low value, they are turned under or used as pasture. Sod land is sometimes rejuvenated by top-dressing with manure, some phosphate fertilizer, or nitrate of soda. Manure (where available) is also used with tobacco and vegetables. Fertilizers are used in small quantities outside the valley. From 250 to 500 pounds of a 3–10–6 mixture an acre is used for corn, and from 250 to 300 pounds of phosphate, together with 100 to 150 pounds of nitrate of soda, for small grains. Potatoes receive from 500 to 1,500 pounds an acre of 4–10–6 or 5–8–7 fertilizer, in which the potash is in the form of muriate.

Most of the commercial apple orchards occur in the hill region. They are for the most part cultivated rather than in sod, the cultivation being continued to mid season and the land then seeded to a cover crop of rye, buckwheat, or clover. Nitrogenous fertilizers are used for the trees, and a small amount of a 3–10–6 mixture is used for the cover crop. Most of the home orchards are in sod, though oats are sometimes used for a cover crop. McIntosh, Baldwin, Wealthy, Delicious, Wagener, Rhode Island Greening, Gravenstein, Northern Spy, Hubbardston, and Williams are the leading varieties of apples. Peaches are grown to a very small extent.

In the valley, particularly on the tobacco and onion farms, the land is kept under clean cultivation. Manure is not produced in large quantities, owing to the scarcity of dairying and other livestock farming so that commercial fertilizers must be depended on in a large measure to keep up the fertility, and large quantities are used. For tobacco, most growers plow the land in the fall and allow it to lie fallow until spring, but some growers do not disturb the ground before spring plowing, claiming this to be the best method. Few tobacco growers use cover crops. For tobacco, the available manure is applied at the rate of 3 or 4 cords[7] an acre, although some growers prefer commercial fertilizers even when manure can be obtained. Tobacco stems and stalks are spread over the tobacco ground in late fall, and lime

[7] A cord of manure averages about 4 tons. A cord of cattle manure ranges in weight from 3½ to 5 tons and of horse manure from 2½ to 4 tons.

is applied in small quantities when needed. Commercial fertilizers are used at the rate of 1 or 1½ tons an acre, and from one-fourth to one-half ton extra is used as a top-dressing where manure can not be obtained. Fertilizers analyzing 5–4–5 to 7–4–7 are the most popular, in which cottonseed meal, castor pomace, and fish scrap are the sources of nitrogen.

Havana Seed is the leading variety of tobacco grown, Connecticut Broadleaf second, and Mongrel, a cross between the two varieties, third.

The selection and preparation of tobacco beds is given much attention. Plots free from infection are selected and sterilized with steam as a precaution. Cottonseed meal, alone or mixed with equal quantities of 6–8–12 fertilizer, is used as a starter for the tobacco plants.

In the valley, tobacco growing determines much of the farm practices. On farms where both onions and tobacco are grown, when potatoes are grown in rotation with onions, which is seldom, the growers are careful not to use muriate fertilizer as it injures the burning quality of the leaf in the following tobacco crop. Tobacco fertilizer is used on most crops in the tobacco sections for the same reason.

Onions, the next crop of importance in the valley, are grown largely with commercial fertilizer. Manure is not used because it contains weed seed, and the fields must be cleared of weeds or other crop refuse, as these interfere with the use of wheel cultivators. Onions receive an application ranging from 1,000 to 2,000 pounds of lime an acre, and from 2,000 to 3,000 pounds of 5–8–7 or 6–8–7 fertilizer, in which superphosphate or bone is the base, is usually applied at one time. However, if needed, another 1,000 pounds of the original grade or of an 8–6–6 grade is applied as a top-dressing in mid season. Cover crops of rye are used on onion land, mainly to prevent the land from blowing and also because rye when plowed under furnishes organic matter with little rubbish to interfere with cultivation. Southport Globe and Yellow Danvers are the leading varieties of onions grown. Much hand work is necessary in growing an onion crop.

Asparagus and sweet corn are given more attention than other market-garden crops. All market-garden crops, except asparagus, are grown on land suited to onions rather than on tobacco land. Acre applications ranging from 1 to 2 tons of lime, from 10 to 12 tons of manure, and from 1,000 to 2,500 pounds of 5–8–7 fertilizer, with a top-dressing of 500 pounds of 8–6–6 fertilizer or nitrate of soda, are used, the top-dressing to force the crop.

On most of the valley farms, the farmer specializes on one crop, but on a few farms more than one crop is grown. Outside the valley the farmers are more nearly what would be called general farmers, in that they all grow a wide range of the staple crops, including apples.

As the Massachusetts Agricultural Experiment Station at Amherst is located on soils similar to those occurring throughout the valley section of Franklin County,[8] the results of certain experiments are of vital interest to the farmers of this county.

The experiment station in a fertilizer test (*2*) found that a single 15-ton-to-the-acre application of manure gave the highest yields of

[8] The station is located on Merrimac fine sandy loam, Agawam very fine sandy loam, Melrose fine sandy loam, Suffield silt loam, Cheshire fine sandy loam, and Cheshire gravelly fine sandy loam.

corn, a slight increase in stover, and a slight decrease in grain over a period of 10 years. Complete fertilizer containing 160 pounds of nitrate of soda, 320 pounds of dissolved bone, and 160 pounds of muriate of potash returned a slightly lower yield than manure, with a drop in the grain yield during the second 5-year period. On land on which no fertilizer was used yields were less than half the yield on the manured land, with a decided drop during the last 5-year period. The yields of corn and corn stover reported in this series of experiments are summarized in Table 6.

TABLE 6.—*Results of fertilizer experiments on corn over a 10-year period*

Kind of fertilizer and period	Yield of stover	Yield of grain
	Pounds	*Pounds*
Manure, first 5-year period	22,000	18,000
Manure, last 5-year period	24,000	16,000
Complete fertilizer, both periods	(1)	(1)
No treatment, first 5-year period	9,000	6,000
No treatment, last 5-year period	5,000	2,000

[1] Slightly less than when manure was used.

The yields of grass and clover in the same series of experiments under different fertilizer treatments, are given in Table 7. In these experiments clover failed where no potash was supplied.

TABLE 7.—*Fertilizer used and average acre yields of grass and clover over a 6-year period*

Kind of fertilizer	Quantity	Quantity of fertilizer constituents			Average acre yield for 6 year period
		Nitrate of soda	Dissolved bone	Muriate of potash	
	Tons	*Pounds*	*Pounds*	*Pounds*	*Tons*
Manure	15				2½
Nitrogen, phosphorus, and potash		160	320	160	1⅔
Phosphorus and potash			320	160	1¼
Nitrogen and potash		160		160	1⅓
Nitrogen and phosphorus		160	320		1⅙
Nitrogen		160			1
No treatment					½

The experiment station recommends seeding timothy and red clover for hay on the well-drained upland soils, and on the wetter lands to add redtop and alsike clover to the grass mixture, increasing the amount on the more poorly drained areas. In orchard experiments (*6*) conducted by the station [9] an application of 10 tons of manure an acre with intertilled crops gave the best results, and 600 pounds of ground bone and 200 pounds of muriate of potash gave fair results. Where no fertilizer was used strip cultivation gave better results than sod. Experiments on Merrimac sandy loam show that manured plots were only slightly better than the unfertilized plots, but where bone and potash were used the yields were better. The fertilizer used contained 600 pounds of ground bone, 320 pounds of sulphate of potash, 160 pounds of muriate of potash, and 225 pounds of sulphate potash-magnesia.

[9] The station orchard is located on a gravelly phase of Cheshire fine sandy loam.

Tobacco (*3, 4, 7*) following tobacco, with the land undisturbed until spring plowing, has been found by the experiment station to give better results than when grown in rotation with other crops, and better results than when cover crops are used, and even better than when the land is plowed in the fall and allowed to lie fallow until planting time in the spring. Tobacco does better following onions, potatoes, and tomatoes than following any other crop. However, if sufficient lime is used for onions or a muriate fertilizer is used for potatoes, the results are not so satisfactory for the following crop of tobacco. A cover crop of timothy proved to be less injurious than other cover crops for tobacco land, but it is not advisable to use this even where the organic content of the land is low or where it is necessary to protect the land from shifting. Injury to tobacco following cover crops is probably caused by a fungous disease, brown root rot.[10]

Where cropped continuously to tobacco, soil sometimes becomes toxic by the accumulation or formation of manganese and aluminum sulphate in the soil caused by the continued use of sulphate fertilizer. (*2, 5.*) This toxic condition was found to be relieved by the use of lime. In the past probably too much lime has been used. The use of excessive amounts of lime is thought to cause black root rot of tobacco. It has been proved that tobacco on land slightly acid, neutral, or alkaline is apt to be damaged by this fungous trouble, and the Connecticut experimenters have found that the best results with tobacco are obtained on medium-acid land. The Massachusetts station used 3,000 pounds of 5–4–5 fertilizer an acre on tobacco land, and this seems to be accepted as a satisfactory tobacco fertilizer. Both the Massachusetts and Connecticut tobacco experiment fields are located on soils which occur throughout the Connecticut Valley and in the tobacco district of this county. As the amount and grade of fertilizer required to grow a tobacco crop are fairly well known, experiments have been carried on by the Connecticut station to determine the best element carrier in order to obtain the best quality and burning properties of the leaf. The experimenters at this station found that old tobacco land gave no response to the use of phosphatic fertilizers. A large amount of lime used for onions, which crop was followed by tobacco, was the origin of much of the tobacco growers' trouble, according to the experimenters at the agricultural experiment stations in both Massachusetts and Connecticut.

Dairying is by far the most important farm industry in the county. It consists of the production of whole milk for market by dairy companies and by individual farmers who keep herds ranging in size from a few cows to many. Dairying is well distributed over the county but is best developed in the foothills west of the valley, in the towns of Bernardston, Ashfield, Leyden, Colrain, Shelburne, Buckland, Conway, and Whately. The milk is collected in cans from the small producers, pasteurized at local stations, and carried in large tank trucks to the near-by city markets.

The value of dairy products sold in 1929 was $1,509,787, divided as follows: Whole milk, $1,331,539; cream, $136,196; and butter, $42,052.

[10] JONES, J. P. HAVANA SEED TOBACCO AS INFLUENCED BY TIMOTHY COVER CROP. Mass. Agr. Expt. Sta. Circ. 73, 3 p. 1925. [Mimeographed.]

Livestock raising is not a very important industry and, aside from the breeding and raising of the cattle necessary to the dairy industry, is confined to the keeping of a few beef cattle, sheep, and hogs, and to the breeding of a few horses. A large number of chickens are kept on the farms of the county for the production and sale of poultry and eggs.

The value of livestock products, other than dairy products, in 1929, was as follows: Wool, $4,916; poultry, $319,040; eggs, $321,791; and honey, $1,850.

The curing and handling of tobacco after the crop is made, is as important as the growing of the crop. Two methods of harvesting are used, the first consisting of cutting the stalk near the base and spearing it on a lath, and the other, of priming, or picking the leaves as they mature and stringing them on a string passed through the stem near its base. The priming method is used mainly with shade-grown tobacco. The tobacco crop is air-cured in ventilated sheds or barns, and charcoal fires are used only to prevent sweating in damp or muggy weather. Hail, wind, and storm insurance is usually carried.

Onions require no special equipment for handling, aside from a grader. The onions are dried, sorted, and sacked in the open, and stored in cooperatively owned or private warehouses, for public storage, or are sold to dealers who store them for winter sale.

A large amount of labor is required for harvesting the apple crop. Apples are picked largely by itinerant laborers, graded, packed into barrels, and stored in local warehouses for winter sale. Some of the crop is disposed of in small baskets at roadside stands.

Potatoes are usually harvested with diggers. Much of the crop is disposed of in bulk on the local markets, but some of the larger growers pack the potatoes in barrels for market. Irish Cobbler, Green Mountain, and Rural Russet are the leading varieties of potatoes grown.

A number of small sawmills are in operation in the hill region, especially in the rougher sections of the western highland. A fair quantity of lumber is manufactured from the forests of the county. Some cordwood is cut from the wood lots nearer the towns.

SOILS AND CROPS [11]

The soils of Franklin County are divided into belts extending north and south across the county. These belts conform closely to the main physiographic divisions of the county—the eastern upland, the Connecticut lowland, the western foothills, and the western plateau. Each belt includes a group or groups of soils which strongly influence the agriculture that has developed on them. The central half of the county, which is the most important agriculturally, is divided into two belts as follows: (1) The Connecticut lowland, including the Connecticut River Valley, the lower reaches of Deerfield River Valley, and the low hills scattered through the valley; and (2) the land occupying the foothills of the western highland lying west of the lowland.

[11] There is an apparent discrepancy in the correlation of the soils along the Worcester-Franklin County line. Owing to changes in the correlation of Massachusetts soils, Gloucester sandy loam in Worcester County is mapped as Gloucester fine sandy loam in Franklin County and Gloucester stony sandy loam of Worcester County is mapped as Gloucester stony fine sandy loam in Franklin County. The correlation change was due to the small area of the sandy Gloucester soils in Franklin County.

These two regions, although entirely different in surface relief and soils, have each developed an agriculture peculiarly suited to the existing conditions. The belt lying east of the lowland comprises the smoothly rounded hills and ridges of the eastern upland, and the belt west of the foothills comprises the western highland consisting of broad flat-topped ridges with narrow V-shaped valleys, the walls of which are mainly rough stony land.

The soils of the eastern upland, like most of the soils of eastern New England, are not inherently poor as is usually considered. Although they are not so fertile as the soils of the western plains or prairie regions of the United States, they are more fertile than most of the soils of the Atlantic coastal plain or piedmont regions and compare favorably in fertility with the nonlime soils of the North Atlantic States. The lack of farm development on these soils is owing largely to the stone content which occurs in such large quantities that it interferes with the use of improved machinery. The structure of these soils is favorable to the root penetration of trees, and the stone content does not interfere with the growing of grass. Aside from comparatively small fairly stone-free patches suitable for crop production, these soils are best suited to pasture and forestry.

The Gloucester soils predominate over the eastern upland. They have brown light-textured fine sandy loam and light loam surface soils, yellowish-brown light-textured subsoils, and gray moderately loose till below a depth of 2 feet. The glacial till from which these soils have developed has been derived from granitic rocks, or at least quartz-bearing feldspathic rocks. A noticeable quantity of granite bowlders and rock fragments is present. The surface relief is rolling or hilly, and drainage is good. The soils of the Essex series are similar to the Gloucester soils, with the exception of a compact substratum that retards underdrainage to some extent. These soils are scattered over the eastern part of the county and are closely associated with the Gloucester soils. The Whitman soils have dark mucky surface soils, mottled gray and yellowish-brown subsoils, and a gray and drab-gray substratum. They occupy poorly drained depressions scattered throughout the eastern upland.

The soils of the Connecticut lowland differ widely from the soils of the eastern upland, in that they contain little or no stone, and are in general level, whereas the upland is prevailingly broken. The lowland soils, like other terrace soils of southern New England, contain less plant food than the upland soils. In this respect and in their general structure, they are more closely related to the soils of the coastal plain of Long Island and New Jersey.

These soils have been derived from material which, as originally laid down, contained less mineral plant food and, owing to their loose structure, have been subjected to a greater amount of leaching than the upland soils derived from glacial till.

The soils of this group are well suited to crop production, as the structure allows ready root penetration and ease of cultivation. They are not so fertile as other soils of this region, in that they require the addition of fertilizer or manure to produce adequate yields. However, they respond readily to improvement. For these reasons they are the best agricultural soils in the county. These characteristics allow the production of such crops as tobacco, onions, and market-garden crops—all crops requiring practically complete control of all factors influencing crop production.

The lowland soils are divided mainly into two groups—the Merrimac group, representing the leading soils of the Connecticut Valley, and the Hadley-Agawam group, including the leading soils of the Connecticut River Valley. The Merrimac soils have brown light-textured fine sandy loam or loamy sand surface soils, light-textured subsoils, and gravelly and sandy substrata occurring below a depth of 20 or 24 inches. In places the surface soil carries much gravel. These soils are developed in level areas but drainage, owing to the loose gravelly substratum, is inclined to be excessive. These soils occur along the outer, or hill, side of the valley, in the northwestern part, and scattered in the valleys of the smaller streams, particularly in the Swift River Valley. The soils associated with the Merrimac soils, and having similar profile development, but with a hummocky surface relief, are the Hinckley soils. These are sandy and gravelly excessively drained soils. The Ondawa soils are well-drained bottom-land soils, are brown or yellowish brown in color, and are fine sandy loam or loamy fine sand in texture. The Agawam and Hadley soils occupy the terraces and flood plains of Connecticut River. They have dark-brown surface soils, paler yellowish-brown or greenish-yellow subsoils, and greenish-yellow substrata. They range from silt loam to loamy fine sand, very fine sandy loam predominating. They are mellow and friable from the surface to a depth of 3 feet or deeper and have fine sandy substrata. They carry no stone or gravel. They predominate in the south-central part of the county in the towns of Deerfield, Sunderland, Whately, and Greenfield. The Agawam soils are developed on the high terraces and the Hadley soils occur on the low terraces and overflow land along Connecticut River. The Enfield, Suffield, Melrose, and Scarboro soils are closely related soils of small extent. They range from silt loam to fine sandy loam in texture and either have heavy substrata or are influenced by them.

The soils of the western foothills, although more broken in topography than the soils of the eastern upland, contain, in general, less stone. However, they contain a noticeable quantity of limestone, the influence of which is reflected in the generally better grass sod growing in this region. These soils are similar to the soils in southeastern Vermont, and on them has developed a similar agriculture which consists of fruit and grass production. The limestone-influenced soils of the western foothills are as well suited to grass as any of the soils of the Eastern States. In general, these soils, like the other upland soils of this county, contain too much stone for use of modern labor-saving machinery, but in spite of this a substantial agriculture is maintained.

The foothill region is dominated by two soils, both of which show well-defined limestone influence but differ mainly in the structure of the substrata. These soils have brown mellow loam surface soils, yellowish-brown loamy subsoils, and greenish-yellow loamy substrata. Both are strongly influenced by limestone material, and both carry a large quantity of stone. The Colrain soils have a firm but not very compact substratum, and the Shelburne soils have a highly compact substratum below a depth of 2 feet. Less extensive soils of the foothills are the Bernardston, Woodbridge, Buckland, and Hollis. Bernardston loam, derived from argillite, is heavier and darker than the other soils and contains less stone. The Buckland soils are similar to the Bernardston soils but contain some limestone material. The

Woodbridge soils are similar to the Shelburne soils but contain little or no limestone material. The Hollis soils have browner and lighter-textured surface soils with a fluffier structure than the rest of the soils of the foothills, and the substratum contains much mica and small pieces of platy schist. These soils consist of comparatively shallow till and contain much ledgy outcrop of the parent rock material.

The soils of the western plateau are similar to the soils of the Berkshire plateau in western Massachusetts and south-central Vermont. The steeper hillsides and valley walls contain equally as much stone as the eastern upland region, but there are numerous somewhat flattened comparatively stone-free ridge tops which would allow crop production so far as soil characteristics are concerned. These areas occur at comparatively high elevations and are isolated by rough country and for this reason are not highly developed.

The soils of the western highland are predominantly stony loams with compact substrata. On the ridge tops and extending down the smoother slopes for some distance, the Worthington and Blandford soils are developed. They are loams containing little stone and having shallow subsoils and in few places are more than 12 or 15 inches to the raw, unweathered till. The substratum, like that underlying most of the soils of the western half of the county, is only fairly heavy but is compact. The Worthington soils are developed in the eastern part of the highland and are influenced to some extent by limestone, and the Blandford soils occur in the western part and show no limestone influence. The Berkshire soils occupy the hillsides and narrow ridges. These soils are loams and stony loams, the stony loams predominating. They have dark-brown surface soils, deep yellowish-brown subsoils, and a greenish-gray fairly compact substratum below a depth of 2 feet. The Becket soils are similar to the Berkshire soils in profile except that they have a grayer substratum, as they are derived from granite, whereas the Berkshire and Blandford soils are derived from schist. The Becket soils consist of loams and stony loams and are developed to a small extent in the northwestern part of the highland adjoining the Vermont State line. The drainage of the soils in the western highland is in general good with the exception of Peru loam, which is imperfectly drained, this condition being shown by mottling in the lower part of the subsoil. This soil is scattered in small areas over the highland.

The alluvial or bottom-land soils are closely related to the other soils of the Eastern States of similar origin. They are young soils of recent deposition and have suffered little or no leaching. Although they do not receive deposits comparable with the alluvial soils of the States where erosion is active, they do receive small quantities of plant food from such sources. These bottom lands, though subject to only occasional overflow, are not used for crops which require expensive preparation of the land or which would entail heavy loss if flooded.

Meadow is the overflow land of the small streams, developed in all parts of the county where drainage is imperfect, and the soil is of various textures. Muck occurs mainly in the valley, where it occupies small stream bottoms and shallow filled-in lakes. Peat occurs mostly in the upland where deep lakes are filled with brown fibrous material. Rough stony land, as its name implies, consists of rough

stony areas which are nonagricultural. Rough stony land is widely distributed over the county, occupying large areas in the western part of the eastern upland, and in the western part of the western highland.

In subsequent pages of this report the soils of Franklin County are described in detail and their agricultural relations are discussed; the accompanying soil map shows their location and distribution; and Table 8 gives the acreage and proportionate extent of each soil in the county.

TABLE 8.—*Acreage and proportionate extent of soils mapped in Franklin County, Mass.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Hadley very fine sandy loam	2,752	0.6	Hollis fine sandy loam	7,168	1.6
Hadley very fine sandy loam, overflow phase	1,792	.4	Hollis fine sandy loam, shallow phase	1,280	.3
Hadley loamy very fine sand	448	.1	Hollis stony fine sandy loam	8,320	1.9
Hadley loamy fine sand, overflow phase	384	.1	Hollis stony fine sandy loam, shallow phase	576	.1
Hadley silt loam	896	.2	Woodbridge loam	1,728	.4
Hadley silt loam, overflow phase	192	.1	Woodbridge stony loam	1,792	.4
Agawam fine sandy loam	10,112	2.3	Buckland loam	3,840	.9
Agawam loamy fine sand	2,432	.5	Buckland loam, shallow phase	1,152	.2
Suffield fine sandy loam	1,344	.3	Buckland stony loam	2,624	.6
Suffield fine sandy loam, steep phase	128	.1	Bernardston loam	4,096	.9
Melrose fine sandy loam	2,944	.7	Bernardston loam, shallow phase	1,152	.2
Scarboro loam	1,728	.4	Bernardston stony loam	4,992	1.1
Enfield fine sandy loam	768	.2	Bernardston stony loam, shallow phase	576	.1
Merrimac fine sandy loam	11,840	2.7	Worthington loam	6,976	1.6
Merrimac sandy loam	5,056	1.1	Worthington loam, shallow phase	512	.1
Merrimac loamy sand	6,848	1.5	Worthington loam, stony phase	4,352	1.0
Ondawa fine sandy loam	2,240	.5	Blandford loam	7,680	1.7
Ondawa loamy sand	384	.1	Blandford loam, shallow phase	2,816	.6
Hinckley gravelly sandy loam	11,520	2.6	Blandford loam, stony phase	3,840	.9
Hinckley loamy sand	5,440	1.2	Berkshire loam	3,520	.8
Manchester gravelly fine sandy loam	128	.1	Berkshire fine sandy loam	1,728	.4
Windsor fine sand	64	.1	Berkshire stony loam	6,784	1.5
Windsor loamy fine sand	704	.2	Becket loam	3,264	.7
Cheshire fine sandy loam	13,248	3.0	Becket stony loam	960	.2
Cheshire fine sandy loam, gravelly phase	192	.1	Peru loam	4,224	.9
Cheshire fine sandy loam, shallow phase	1,920	.4	Gloucester loam	1,600	.4
Cheshire sandy loam	960	.2	Gloucester stony loam	3,968	.9
Colrain fine sandy loam	8,768	2.0	Gloucester fine sandy loam	6,592	1.5
Colrain fine sandy loam, shallow phase	9,600	2.2	Gloucester stony fine sandy loam	55,168	12.5
Colrain loam	2,048	.4	Essex loam	704	.2
Colrain stony fine sandy loam	9,152	2.1	Essex loam, stony phase	2,816	.6
Colrain stony fine sandy loam, shallow phase	10,240	2.3	Whitman stony loam	1,472	.4
Colrain stony loam	1,280	.3	Meadow	23,424	5.3
Shelburne loam	4,480	1.0	Muck	1,280	.3
Shelburne loam, stony phase	2,880	.6	Peat	320	.1
			Rough stony land	124,032	28.0
			Total	442,240	

THE SOILS OF THE CONNECTICUT LOWLAND

The Connecticut lowland including the low hills within its bounds, is divided in two parts, each part including a group of soils, which dominates the agriculture in that part. The Connecticut River Valley and the lower reaches of the Deerfield River Valley, together with adjacent terraces in which the Hadley and Agawam soils predominate, produce nearly all the tobacco and onions grown in the county. These soils are deep and mellow, mainly very fine sandy loams or loamy fine sands, and are of excellent structure, which allows easy root penetration and good moisture-absorbing and moisture-holding capacity. They are naturally more productive than soils of the Merrimac group in that they are derived from more recent deposits which have not been subjected to leaching as have the soils of the older group. These

properties enable the crops on these soils to utilize, to the fullest extent, fertilizers which have been added, and such crops as tobacco and onions not only produce heavy yields but also a high proportion of top-grade products. These soils are suited to a wide range of crops in addition to onions and tobacco, but as these two crops give a high average acre return they are grown more extensively on these soils than other crops. Some of the highly specialized market-garden crops give higher returns where close to markets, but Franklin County, as a whole, is too far from markets to grow this type of produce profitably on a large acreage. The level surface and freedom from stone allows the use of the wheel hoe in the cultivation of onions. A large Polish population in the valley supplies the hand labor necessary in the growing of onions or crops requiring an unusual amount of hand labor and little capital to begin operations.

The practices followed in growing onions and tobacco do not include the use of cover crops or rotations, and most of these soils, unless used for other crops, are deficient in organic matter. However, the farmers do not attempt to grow onions and tobacco without using from 1 to 1½ tons of fertilizer to the acre. From 3 to 4 cords of manure are used for tobacco, but no manure is used for onions. The other crops grown are corn (grain and silage), hay, small grains, and vegetables.

The Hadley soils have light-brown surface soils from 6 to 12 inches deep, greenish-yellow subsoils, and a greenish-gray substratum below a depth ranging from 30 to 36 inches.

The Agawam soils occupy a higher terrace than the Hadley soils, which lies well above all possibility of overflow. The surface soils and subsoils are browner, especially the lower part of the subsoils to a depth of 18 or 20 inches, but the substrata are much the same to a depth of 4 feet, at which depth the Agawam soils contain much coarse sand.

A smaller group of valley soils, associated with the Hadley and Agawam soils and on which crop practices are much the same, embraces the Suffield, Melrose, Scarboro, and Enfield soils. The outstanding feature of these soils is the heavy layer in the substratum, at a depth varying with the type of soil, that prevents thorough underdrainage. The moisture-absorbing and moisture-holding capacity of these soils is good, and crops rarely suffer in dry seasons from lack of moisture but may fail in wet seasons.

Crop yields on soils of this group are equally as good as on the Agawam soils, and sometimes higher. Tobacco and onions on the Suffield and Melrose soils in a normal season yield higher than on any soil in the county, yields ranging from 1,000 to 2,000 pounds of tobacco and from 1,000 to 1,200 bushels of onions an acre. In a wet season, yields of these crops are low. Yields of corn, grass (hay and pasture), and vegetables, compare favorably with yields on the the other terrace soils.

North from Deerfield River in the Connecticut Valley and in the Enfield Valley, which is occupied by Swift River, the soils of the Merrimac series are developed. They are light-textured fairly level well-drained soils occurring on the old terrace levels. The texture ranges from sandy loam to loamy sand, and in some places the material is gravelly. The surface soils are brown, the subsoils are light brown or yellowish brown, and the substratum, which occurs below

a depth of 2 feet, is gravelly and sandy. The surface soils are mellow, the subsoils are firm but not compact, and the substratum is loose. These features, except in the sandier types, enables these soils to absorb and retain sufficient moisture for crops except in dry seasons. Drainage is such that even in wet seasons crops do not drown, but there is some danger of loss of fertilizer by leaching. Although some gravel is present, in few places is there enough in the surface soil to interfere with cultivation. These soils are easy to cultivate and can be worked a short time after rains without serious effects. The structure allows easy root penetration, and, although the soils are not naturally productive, they make an excellent medium in which to grow crops after nearly all the soil enrichment is supplied.

The Ondawa soils have the same characteristics as the Merrimac soils, with the exception that they contain little or no gravel to a depth of 3 feet. They occupy bottom land along the smaller streams and lie above normal overflow but not beyond the possibility of inundation, as the spring freshets usually cover the land. Drainage is well established.

The Hinckley soils and the closely related Manchester and Windsor soils occur along the edges of the Connecticut Valley and the smaller stream valleys. They resemble the Merrimac soils, but have a decidedly hummocky surface relief. The broken relief, together with the loose substratum, affords excessive drainage, and crops suffer even in a moderately dry season. Most of the land is too steep and broken for the use of mowing machines. The Windsor soils represent windblown material and are scattered in small areas over the terraces of the Connecticut Valley. They consist of sandy material throughout and are excessively drained.

The hills throughout the Connecticut Valley consist mainly of Cheshire soils which have brown mellow surface soils to plow depth and reddish-brown or yellowish-brown fine but friable subsoils, grading at a depth of 20 or 24 inches into red or pink firm but not compact till.

Hadley very fine sandy loam.—Hadley very fine sandy loam, which covers an area of 2,752 acres, is a slightly better soil than the Agawam soil of the same texture, and is probably the most important agricultural soil in the county. Crop yields are usually high, tobacco yields ranging from 1,200 to 2,000 pounds, depending on the previous condition of the land and the season, with an average yield between 1,500 and 1,800 pounds an acre. Onions yield from 500 to 1,000 bushels an acre, but in wet seasons the yield may fall as low as 100 bushels, as it did during the past season (1928). Smaller quantities of fertilizer are used for other crops, but a fair amount is used on market-garden crops. Potatoes yield from 150 to 250 bushels an acre; corn (grain), from 50 to 75 bushels; corn (silage), from 12 to 15 tons; hay, from 1½ to 2 tons; and alfalfa, from 2 to 2½ tons.

This soil is naturally well drained. It is easily cultivated and its freedom from stone and gravel makes it easy to handle.

Hadley very fine sandy loam, overflow phase.—This soil lies at a slightly lower level than typical Hadley very fine sandy loam and is subject to the annual spring freshets and to fall freshets about once in 20 years. Crops are seldom damaged by floods. However, such crops as tobacco and onions, which require a heavy outlay for fertilizer and equipment, are seldom planted on this soil, as the risk of

overflow is too great. The land is used for mowing, pasture, corn, and vegetables. Crop yields in general average slightly lower than on the typical soil.

Hadley loamy very fine sand.—Hadley loamy very fine sand has a slightly lighter texture and is slightly less capable of holding moisture than Hadley very fine sandy loam. It is not so extensive, and therefore not so important agriculturally. It occurs as slightly higher ridges, associated with Hadley very fine sandy loam, and is used for the same crops in about the same proportion. Rye is used more extensively as a cover crop to prevent blowing, and possibly more of this land is under grass sod for the same reason. It is used successfully for asparagus, and to less extent for other vegetables. Land of this kind is slightly less productive than Hadley very fine sandy loam.

Hadley loamy fine sand, overflow phase.—Typical Hadley loamy fine sand is not mapped in Franklin County but is represented by an overflow phase which, like the overflow phases of the other Hadley soils, lies so low that it is not highly valued as an agricultural soil. However, drainage is well established, and the land is used mainly for mowing and pasture. Fair crops of corn and vegetables are grown. Little fertilizer is used.

Hadley silt loam.—Hadley silt loam is slightly heavier textured than the other soils of the Hadley series and usually occurs on lower levels and in positions near the hill edge of the terraces. This soil is used to a greater extent for hay, corn, and small grain than the other Hadley soils and to somewhat less extent for onions and tobacco. The yields of hay, corn, and small grains compare favorably with those on Hadley very fine sandy loam. This soil is not quite so easy to handle as the lighter soils. Crops are more inclined to drown in wet seasons, and the land remains cold later in the spring.

Hadley silt loam, overflow phase.—The overflow phase of Hadley silt loam occupies rather low back bottoms and includes many areas having imperfect drainage. This land is used for mowing and pasture to a greater extent than the overflow phases of other Hadley soils.

Agawam fine sandy loam.—Agawam fine sandy loam is used for the same crops as Hadley very fine sandy loam but the yields are slightly less for all crops except tobacco which returns about the same yields. The total area of Agawam fine sandy loam is 10,112 acres. It is the most extensive farming soil in the county.

Agawam loamy fine sand.—Agawam loamy fine sand occupies almost one-fourth as large an acreage as Agawam fine sandy loam and is used to a smaller proportionate extent for crops as about 40 per cent of the land is in forest, whereas nearly all the fine sandy loam is cleared and utilized. Although used to less extent for onions, the loamy fine sand is used almost as extensively for tobacco as the fine sandy loam and to greater extent for shade-grown tobacco. Asparagus also is grown. Yields of all crops are smaller than on the fine sandy loam, as this soil is less retentive of moisture. Tobacco yields range from 800 to 1,000 pounds an acre for shade-grown tobacco, and from 1,200 to 1,500 pounds for tobacco grown in the open. This soil has a tendency to drift, and cover crops are used on much of the cultivated acreage as a preventive. Where this practice is not followed, as with the tobacco crop, soil drifting is a serious problem.

Suffield fine sandy loam.—Suffield fine sandy loam occupies 1,344 acres in the county. It has a dark-brown surface soil and a pale yellowish-brown subsoil which passes into greenish-yellow or olive-colored clay loam at a depth of 20 or 24 inches. In some areas the surface covering of sandy material is thin or lacking, and in such places the surface soil is loam or silt loam in texture. These heavier areas are used almost entirely for mowing and pasture.

Suffield fine sandy loam, steep phase.—The broken edge of the terraces, mapped as a steep phase of Suffield fine sandy loam, is steep and is not suited to the production of crops. It is in forest or pasture.

Melrose fine sandy loam.—Melrose fine sandy loam is developed on the level terraces in the vicinity of Deerfield and Whately. It has a dark-brown surface soil, yellowish-brown light loamy sand subsoil, and at a depth of 20 or 24 inches passes into a substratum of clay which extends to a depth ranging from 40 to 48 inches below the surface. Drainage is well established.

Scarboro loam.—Scarboro loam has a very dark brown loam or fine sandy loam surface soil from 6 to 12 inches thick, passing into a dull yellowish-brown subsoil which becomes lighter with depth to the point where the clay substratum occurs at a depth below 3 feet. This soil occurs on level areas that have poor natural drainage. It is used to some extent for farming, mainly for hay and pasture. It is of small extent and unimportant agriculturally.

Enfield fine sandy loam.—The surface soil of Enfield fine sandy loam is brown loamy fine sand or sandy loam, and the subsoil is yellowish brown or reddish brown. The subsoil rests on a bed of red till at a depth ranging from 20 to 24 inches below the surface. This till is similar to the clay substratum in that it retards drainage, though to less extent.

Merrimac fine sandy loam.—Merrimac fine sandy loam is used for hay, corn, potatoes, and vegetables, and for tobacco to some extent in the Connecticut Valley, but very little tobacco is grown on areas outside the valley. Tobacco yields from 1,000 to 1,400 pounds an acre, corn from 40 to 60 bushels, oats from 45 to 65 bushels, and potatoes from 125 to 250 bushels. About 60 or 65 per cent of the 11,840 acres of this land is used for agriculture.

Merrimac sandy loam.—Merrimac sandy loam is used for the same crops as the fine sandy loam, but the crop yields are somewhat lighter. It occupies an area less than half that occupied by Merrimac fine sandy loam.

Merrimac loamy sand.—Merrimac loamy sand is little used for farming, and on land used for crops the yields are very low. From 65 to 75 per cent of this land is covered with a growth of scrub oak and pitch pine. Many abandoned fields are covered with broom sedge and cinquefoil.

Ondawa fine sandy loam.—Ondawa fine sandy loam is used for hay, pasture, corn, and vegetables. Crop yields compare favorably with those on the Merrimac soils. Ondawa fine sandy loam as a rule does not receive much fertilizer, but being an overflow soil it is naturally more fertile than some other soils.

Ondawa loamy sand.—Ondawa loamy sand is less productive than Ondawa fine sandy loam and is used to only a small extent for crop production.

Hinckley gravelly sandy loam.—Hinckley gravelly sandy loam is extensive, occupying 11,520 acres. It is little used for farming. About one-half the land is cleared and used for pasture, but the grass is very indifferent.

Hinckley loamy sand.—Hinckley loamy sand is of low agricultural value and is not used for farming.

Manchester gravelly fine sandy loam.—Manchester gravelly fine sandy loam, which has a browner surface soil and slightly firmer and deeper subsoil than the Hinckley soils, may be distinguished mainly by the red or pink color of the gravel and sand in the substratum. It occurs along the hill edge of the Connecticut Valley. It is more productive than the Hinckley soils and is used for orcharding to some extent, also for pasture. Although crops may suffer from lack of moisture in dry seasons, this soil is not so leachy as the Hinckley soils, and grass does much better.

Windsor fine sand.—Windsor fine sand is covered with scrub oak and is not used for farming.

Windsor loamy fine sand.—Windsor loamy fine sand is used to a limited extent in the production of tobacco, rye, and redtop. The last two crops are planted to prevent drifting. Tobacco makes light yields.

Cheshire fine sandy loam.—Cheshire fine sandy loam occupies 13,248 acres and is the most representative type in the Cheshire series. In places it contains some gravel and stone, derived from the sandstone and conglomerate of the Triassic rocks of the valley formations. The subsoil and substratum are easily penetrated by roots, and the moisture-absorbing and moisture-retaining capacity of the soil are good. Although the surface soil and subsoil are acid, the substratum is only very mildly acid.

Probably less than half the land is used for farming. The crops grown are hay (timothy, clover, and alfalfa), corn, small grains, vegetables, orchard fruits (apples, peaches, and other fruits), and pasture. This soil is suited to the production of legumes, such as clover and alfalfa. Owing to the small content of stone, the land is easily tilled and is used for small grains, as the sod is turned oftener than on most of the upland soils and small grains are used as nurse crops. Crop yields are in general good, comparing favorably with those on the other upland soils derived from till. Corn for silage, for which purpose most of the corn is grown, yields from 10 to 12 tons an acre; hay (timothy), from 1½ to 2 tons; alfalfa, from 1½ to 2½ tons; and potatoes, from 150 to 200 bushels. Apples, peaches, and other fruits, including grapes, do exceptionally well. The high yields are due to farming methods rather than to natural productivity of the soil.

Cheshire fine sandy loam, gravelly phase.—The gravelly areas of Cheshire fine sandy loam are mapped as a gravelly phase. This soil is used more extensively than the typical soil for orchards.

Cheshire fine sandy loam, shallow phase.—In places, the depth to sandstone bedrock in Cheshire fine sandy loam is less than 3 feet from the surface. Such areas are small and have been mapped as a shallow phase of the typical soil. It is of low agricultural value.

Cheshire sandy loam.—Cheshire sandy loam is used to a small extent for feed crops, and the yields are lower than on the fine sandy loam. The stony areas, where cleared, are used mainly for pasture and to a small extent for mowing and orchards.

FOOTHILL SOILS

Notwithstanding the broken surface and generally stony character of the foothill section of Franklin County, an agriculture second only to that in the valley section has been built up and maintained in this region. This is owing more to the limestone influence in the soils than to any other factor. Drainage, as in most hill regions, is well established.

Two soils dominate the agriculture of this section, Colrain fine sandy loam and Shelburne loam. These two soils, although they differ but slightly in texture, differ widely in the character of their substrata. The substratum of the Colrain soils is firm but not compact, whereas that of the Shelburne soils is compact. Both soils are more or less influenced by limestone. Fully 75 per cent of the apple trees, 40 per cent of the mowing, and 50 per cent of the pasture of the county are on these and closely related soils of the foothill section.

The Colrain series is represented in Franklin County by four soils and two phases of soils. These soils have brown mellow fine sandy loam surface soils, yellowish-brown subsoils of similar texture, and greenish-gray light till substrata which have been little affected by weathering. Scattered over the surface and embedded in the soil are limestone bowlders in various stages of decomposition. Drainage is good. The forest cover includes hemlock and beech in large numbers, some white birch, gray birch, ash, butternut, hard maple, white pine, and aspen, together with a few white oaks and red oaks. These soils are used for pasture, mowing, corn, and very extensively for apple orchards.

The Shelburne soils have dark-brown surface soils extending to a depth of 6 or 8 inches, underlain by a light-brown firm loam subsoil which becomes greenish yellow or olive colored at a depth ranging from 15 to 20 inches, and, in turn, passes at a depth ranging from 24 to 30 inches into a dark greenish-yellow or olive-colored compact substratum which extends to a depth of 20 feet or deeper. Limestone bowlders in various stages of decomposition are in the soil mass, but these soils, like all soils developed from deep till, have comparatively few stones on the surface.

The Hollis soils in this county include the fine sandy loam, with a shallow phase, and the stony fine sandy loam, with a shallow phase. These soils occupy a narrow strip along the eastern edge of the foothills and a few scattered areas on the lower hillsides of the Deerfield River Valley walls. The Hollis soils are the counterpart in soil profile of the Colrain soils, with the exception that the Hollis soils have not been influenced by limestone. They are derived from a schist high in mica, and the substratum in most places is filled with fragments of this rock. With the exception of the loam, which is of small extent in Franklin County, the Hollis soils have low productive power. They are used for the same crops as the Colrain soils, but to less extent. The yields of most crops are lower than on the corresponding Colrain soils.

The Woodbridge soils occupy some of the hillsides and foothills in the eastern part of the western highland. The color and structure are identical with those of the Shelburne soils, but the Woodbridge soils show no limestone influence, and the brown spots which contain weathered limestone are lacking. The compact substratum contains few weak spots, and although not absolutely water-tight, retards, to

a marked degree, the downward movement of water, so that the free water moves along the top of the substratum and comes out on the hillsides as seepage.

The Buckland soils occur near the base of the western highland, occupying fairly steep or gently sloping hillsides. They have a profile similar in some respects to that of the Shelburne soils, but the substrata are heavier in texture, bluish green or olive green in color, and less compact than the substrata of the Shelburne and Woodbridge soils. The Buckland soils are influenced by limestone but for some reason are more acid than the Shelburne soils. The heaviness of the substratum retards the movement of moisture to some extent, and the position of these soils adjacent to the highlands is responsible for a certain amount of seepage water.

The Bernardston soils are unique in their occurrence in Franklin County, representing the extension of a larger area of these soils that projects southward from Vermont. They occur only in the towns of Bernardston and Leyden in the north-central part of the county. They have dark yellowish-brown or dark-yellow loam surface soils to normal depth, underlain by greenish-yellow loam subsoils that change within a few inches into dark greenish-gray firm silty clay loam. At a depth of about 2 feet the subsoils grade into dark greenish-gray heavy fairly compact till that contains numerous fragments of dark-blue slate, the parent material. These soils are fairly well drained.

Colrain fine sandy loam.—Colrain fine sandy loam, covering an area of 8,768 acres, is probably the most important agricultural soil in the foothill section of Franklin County. It consists of brown or dark-brown mellow fine sandy loam to plow depth, passing into a yellowish-brown firm but friable fine sandy loam subsoil, which becomes paler with depth, and, at a depth of 2 feet, grades into a greenish-yellow or olive-colored fairly firm, but not compact, substratum. Scattered through the soil to the underlying till and on the surface are numerous bowlders of partly disintegrated limestone. A few spots of brown porous material, which represent pieces of limestone from which the carbonates have been removed and many of which contain a core of hard limestone, occur in the soil in most places. The subsoil and substratum are mildly acid or neutral. The structure of this soil allows easy root penetration into the substratum. Although the moisture-absorbing and moisture-holding capacity are good, these soils, like most soils of this region having light subsoils or subsoils that lack compaction, may produce short crops in excessively dry seasons. Therefore, the crops grown are mainly those adapted to the soil conditions.

About 65 or 75 per cent of this land is cleared and used for farming. Grass (hay and pasture) and apples are the leading crops, and these crops are grown on a larger acreage on this soil than on any other soil in the county. Corn, potatoes, and vegetables are grown on a fair acreage. Hay yields from 1 to 1½ tons an acre, and corn from 35 to 65 bushels, with an average of about 45 bushels, depending on the season and the amount of fertilizer used. The low average yield for this soil is owing to the generally lower yields in dry seasons, to the small amounts of fertilizer used, and to the larger acreage in crops. Corn for silage yields from 10 to 12 tons an acre, potatoes yield from 125 to 250 bushels with an average of about 150 bushels, small grains do fairly well, and clover is a successful crop.

Pasture is fairly good as it contains much bluegrass. Apples do exceptionally well.

Colrain fine sandy loam, shallow phase.—Colrain fine sandy loam, shallow phase, is used mainly for mowing and to a smaller extent for pasture. The underlying schist bedrock in many places comes within 3 feet of the surface, and such areas are not suited to orchards.

Colrain loam.—Colrain loam occurs mainly in the towns of Colrain, Shelburne, and Leyden, where it adjoins an extensive area of this soil extending northward into east-central Vermont. Colrain loam is a slightly better soil than Colrain fine sandy loam, having the same general characteristics but holding moisture to better advantage. It is used for the same crops, grown in about the same proportions, as those grown on the fine sandy loam, and the yields are slightly higher on the loam. The total area is small.

Colrain stony fine sandy loam.—Colrain stony fine sandy loam is closely associated with Colrain fine sandy loam. A larger proportion of this soil is cleared than of many stony soils, not because it contains less stone, but because the fine soil material is well suited to grass. The stone content in most places is sufficient to prevent the use of mowing machines, and most of the cleared area is used for pasture.

Colrain stony fine sandy loam, shallow phase.—Most of the shallow phase of Colrain stony fine sandy loam is in forest, and the small cleared areas are used for pasture.

Colrain stony loam. -Colrain stony loam is similar to the stony fine sandy loam in all characteristics except the heavier texture of the interstitial soil material. The stone content is sufficient to prevent the use of machines, and most of the cleared areas are used for pasture. A few orchards are on this soil.

Shelburne loam.—Shelburne loam, occupying 4,480 acres, is the most important member of the Shelburne series in the county. It is used for the same crops as Colrain fine sandy loam with about the same success. A larger acreage of this soil is used for mowing, but pasture and orchards occupy a slightly smaller acreage than on the Colrain soils. Corn, potatoes, and vegetables are probably grown more extensively. The compact substratum is highly retentive of moisture, and crop yields are slightly better than on the Colrain soils in dry seasons. The compact substratum, though not impervious to root penetration, somewhat retards root development below that point. Such crops as grass and clover are well suited to the land, and hay yields from 1 to 2½ tons an acre. The pastures contain much bluegrass. Potatoes make slightly lower yields than on the Colrain soils. Corn yields from 45 to 65 bushels an acre and from 10 to 15 tons of silage. This soil is not quite so well suited to apples as the Colrain soils but is used to some extent, ranking second in orchard acreage.

Shelburne loam, stony phase.—Shelburne loam, stony phase, is a better soil than most of the stony soils in this county, because of the limestone content and because the stones are not so numerous. It is used mainly for pasture and furnishes equally as good grazing as the typical soil, but it is not so well suited to other crops.

Hollis fine sandy loam.—Hollis fine sandy loam is used more successfully for orcharding than for any other crop. It is used for the same crops as Colrain fine sandy loam but is less productive.

Hollis fine sandy loam, shallow phase.—This shallow soil is of little crop value. Most of the land is in pasture.

Hollis stony fine sandy loam.—Like other Hollis soils, this soil is used mainly for pasture. Some of the land is in apple orchards.

Hollis stony fine sandy loam, shallow phase.—This soil is inextensive and of very little agricultural value other than for pasture.

Woodbridge loam.—Woodbridge loam is not so extensive in Franklin County as in Hampden and Hampshire Counties. It occupies gently sloping or smoothly rounded hills. A larger area than of the Shelburne soils is in forest, and the acreage used for pasture is relatively large. The cultivated areas are used for the same crops as are grown on the Shelburne soils, but the yields are somewhat lower. Woodbridge loam is fairly good grassland, and mowings cut fair to good crops of hay. Corn silage makes good yields, averaging between 10 and 12 tons an acre.

Woodbridge stony loam.—Woodbridge stony loam is mainly in forest, including beech, hard maple, and hemlock. Some small cleared areas are in pasture. The stones consist of many granitic bowlders.

Buckland loam.—Probably half of Buckland loam is cleared and used principally for mowing, pasture, corn, and small grains. Yields of these crops are slightly better than on Colrain loam.

Buckland loam, shallow phase.—The shallow phase of Buckland loam is not extensive. Owing to the slight depth to bedrock, averaging about 2 feet, this soil is not so well suited to crop production or orcharding. Shallow-rooted crops, such as grass crops, seem to thrive. This soil is more productive than the Hollis soils.

Buckland stony loam.—Buckland stony loam is in forest and pasture. The yields of grass and small grains are good, comparing favorably with those on the Colrain and Shelburne soils. The acidity does not reduce the yields of these crops, but the soil is not quite so well suited to clover. It is used for orcharding rather extensively, as it occupies advantageous positions having southeastern exposures and a protected background. The substratum is not compact enough to prevent penetration by roots.

Bernardston loam.—Bernardston loam occupies the ridge tops, and covers a total area of 4,096 acres. It is used for the crops common to the upland of this county. The largest acreage is in mowing. Hay yields range from 1 to 1½ tons an acre; corn from 35 to 40 bushels; and corn silage from 10 to 12 tons.

Bernardston loam, shallow phase.—The shallow phase of Bernardston loam is little used other than for mowing.

Bernardston stony loam.—Bernardston stony loam occurs mainly on the hillsides. Most of it is in forest and the small cleared areas are used for pasture.

Bernardston stony loam, shallow phase.—This shallow soil is of little agricultural value other than for pasture.

SOILS OF THE WESTERN HIGHLAND

The soils on the flattened ridges of the western highland, particularly the Worthington soils, are naturally good grasslands. This is mainly the result of two factors—the accumulation of organic matter in the surface soil to a greater extent than is common in the brown forest soils, and the small amout of leaching that has taken place.

Hence both mineral and organic plant foods abound in the upper part of the soil, where they can be readily reached by grass roots. The fact that these soils have heavy subsoils and compact substrata that might be detrimental to deep-rooted crops does not affect their use as grassland. The soils of the foothills, the Colrain and Shelburne, owe their grass-producing powers to the limestone influence, which is the rapid liberation of mineral elements by decomposing limestone, including carbonates. The heavy yields of grass from the soils of the eastern upland is owing largely to soil improvement. The sandier soils of the valley are not particularly suited to grass, and the yields are low in most places. The better low terraces and bottom lands, including the Hadley and Agawam soils, owe their productiveness to their inherent productive qualities, to structure, and to soil improvement.

Although there is a large area of rough stony land in the eastern upland, there is a larger area in the western highland, especially along the western border of the county. This large area of rough stony land leaves only a comparatively small area of land suited for farming. Owing to the generally isolated location, agriculture in the western highland has not developed to the extent that it has in other parts of the county, and this condition also accounts for the large number of abandoned farms in this section.

The western highland may be divided into two parts—an eastern belt, composed of rather broad flat-topped ridges on which the Worthington soils are developed, and a western hill belt in which the Berkshire and Blandford soils predominate. The soils of the western highland have one common characteristic, that is, a compact substratum which lies at a different depth in the different soils.

The Worthington soils are characterized by heavy dark-brown surface soils, pale-yellow subsoils, and greenish-yellow or olive-colored substrata. These soils occur almost entirely on the ridge tops. They are derived from dark graphitic schist and impure limestone.

The Blandford soils are identical with the Worthington soils, with the exception that they contain no limestone material. For this reason, they are slightly inferior agricultural soils. They occur in similar topographic positions to the Worthington soils.

The Berkshire soils occur on the more rolling hills and hillsides of the western highland, which are not occupied by rough stony land. They include the loam, the fine sandy loam, and the stony loam, and all carry varying quantities of stone. These soils have dark-brown surface soils, ranging from 5 to 8 inches deep, overlying yellowish-brown or rust-brown firm but friable loam subsoils that become gradually paler and mealy below a depth of 18 or 20 inches. They merge into somewhat compact greenish-yellow or olive-colored till below a depth ranging from 24 to 30 inches. These soils are derived mainly from schist, and fragments of this material are scattered throughout the soil mass. In the stony type, especially, ledges of the underlying rock come within 3 feet of the surface and are even exposed in spots.

The Becket soils are inextensive. They are closely associated with the Berkshire soils, but are derived from gneiss material. They occur on smooth hilltops and hillsides, the loam usually occupying the hilltops and the stony loam the hillsides. The soil profile is much the same as that of the Berkshire soils, except that the subsoil is

deeper brown in color and of greater depth, signifying better drainage, better aeration, and better oxidation even on the more level ridge tops, where Blandford loam normally occurs over the schist material.

The Peru soils occupy the imperfectly drained areas in the smoother regions of the western highland. The mottled condition of the substratum is indicative of the poor drainage.

Worthington loam.—Worthington loam is agriculturally the most important soil of the western highland. It covers an area of 6,976 acres, mainly in the towns of Ashford, Hawley, and Heath. The surface relief ranges from fairly level to smoothly sloping, and in few places is it steep. Drainage is well established. The surface soil is dark-brown loam to a depth of 8 or 10 inches, where it passes into yellowish-brown loam which, within a few inches, becomes pale yellow, passing at a depth ranging from 12 to 18 inches into greenish-yellow or olive-colored fairly compact till little affected by weathering below a depth of 20 inches. This soil does not allow deep penetration of roots, except those of trees, and many of these do not pierce the compact substratum. As roots readily penetrate the soil to a depth of 1½ feet, the land is suited to shallow-rooted crops, grasses in particular, and as the soil has been subjected to little leaching it contains a rather high proportion of plant food. The dark color is caused partly by the grass cover and partly by the parent rock material. This soil, although influenced by limestone, is acid, owing to the high organic content, to the level surface, and to the compact substratum which prevents excessive underdrainage. Although there is little evidence that the soil is poorly drained, there is evidently a lack of oxidation which accounts for the acidity. Although little fertilizer is used on this land, crop yields are good. The comparative freedom from stone and the level surface make the land easy to cultivate and allows the use of machinery. Only a small proportion of the total area of this land contains sufficient stones to interfere with cultivation. Most of the land is cleared, and a comparatively large area is in mowing. Although some of the mowing land is not cut each season and a fairly large acreage represents worn-out grassland, most of it produces enough hay to repay harvesting. When the mowing land is improved the yield of hay is fairly high. Hay yields range from 1 to 2 tons an acre; corn for grain, from 60 to 80 bushels, with higher yields in some seasons; and potatoes, from 150 to 200 bushels, according to the season.

Little is done to improve the sod land, but the grass stand is usually heavy, and where a sod is turned and the land planted to corn the yields are usually high. In dry seasons the corn yield, especially of silage corn, is heavier than on the best valley soils. The greatest danger to corn on this land is damage by frost. Small grains do exceptionally well but are grown to such a small extent as to be almost negligible.

Worthington loam, shallow phase.—The shallow phase of Worthington loam is associated with the typical soil. It is of much less value for crop production, especially for deep-rooted crops, but produces good grass. As there is little stone to interfere with mowing machines, it is almost as good for mowing as the typical soil.

Worthington loam, stony phase.—The stony phase of Worthington loam is not nearly so desirable as the shallow phase. The stones

interfere with plowing and the operation of mowing machines. As the land furnishes good grass it is nearly all cleared and used for pasture.

Blandford loam.—Blandford loam is developed on the hills to the west of the ridges on which the Worthington soils occur. It has a soil profile similar to Worthington loam, except that the surface soil is not quite so dark or deep and the brown subsoil averages slightly deeper. Blandford loam has little or no limestone influence as it is derived almost wholly from schist. It is less productive, in that the natural grass sod is not so good as that on Worthington loam, with the consequent lessened organic content in the surface soil.

Blandford loam, shallow phase.—Blandford loam, shallow phase, bears the same relation to typical Blandford loam as the shallow phase of Worthington loam bears to that soil.

Blandford loam, stony phase.—Blandford loam, stony phase, as its name implies, is simply Blandford loam which carries so much stone on the surface and through the soil as to render the land noncultivable. It is used as pasture.

Berkshire loam.—Berkshire loam, although not extensive as compared with Berkshire stony loam, is, agriculturally, the most important Berkshire soil mapped in Franklin County. It is used for mowing and pasture, with a small acreage, including some orchards, in other crops common to the county. The yields are about the same as on the Blandford soils. Mowing machines can not be so conveniently used because of the surface relief and the stone content. The soil is deep, and such crops as potatoes make as high yields as on any soil in the county, producing as much as 250 bushels an acre in some places. Protected locations are well suited to apples, but there is danger of winterkilling of the trees at the higher elevations.

Berkshire fine sandy loam.—Berkshire fine sandy loam is a lighter-textured soil, not quite so well suited to grasses but equally well suited to potatoes and apples as Berkshire loam.

Berkshire stony loam.—Berkshire stony loam is used to a very small extent for growing crops. Most of the cleared areas are in pasture as the stones not only interfere with the use of mowers but also with cultivation.

Becket loam.—Much of the area of Becket loam is in forest. The small cleared area is used for mowing and pasture. Yields of hay are about the same on this soil as on Berkshire fine sandy loam, and potato yields are slightly lower than on Berkshire loam. The texture and structure allow easy root penetration and the moisture-absorbing and moisture-holding capacity of the soil are fairly good. The yields of most crops compare favorably with those on Berkshire loam. Little effort is made to improve mowings.

Becket stony loam.—Becket stony loam, with the exception of a few areas in pasture, is in forest. The isolated location of areas of this soil, together with the stone content, is principally responsible for the lack of improvement on them.

Peru loam.—Peru loam has a very dark brown fairly deep surface soil, underlain by a yellowish-brown subsoil which becomes pale yellow, mottled with brown and gray, below a depth ranging from 15 to 18 inches. At a depth of about 2 feet a greenish-gray or gray compact substratum, which retards the downward movement of drainage

water, is present. The surface relief is level or gently sloping, and the surface water does not move off rapidly. However, this soil can not be considered as poorly drained as the Whitman soil. Much of this land contains sufficient stone to interfere with cultivation.

The total area of this soil is not large, but the areas are well scattered over the western highland, and a few spots occur in the upland east of the valley. From 50 to 65 per cent of the land is cleared and used mainly for pasture, with a few small areas in mowing. Other crops are not grown. The pastures contain much brush, as hardhack, blueberries, and gray birch. Hay yields range from one-half to 1 ton an acre. This land furnishes good grass even in dry seasons.

SOILS OF THE EASTERN UPLAND

The agriculture of the eastern upland is well distributed over the entire section. It reaches its best development on Gloucester loam, Gloucester stony loam, Gloucester fine sandy loam, and Essex loam. These soils, although comprising a comparatively small part of the total area of the eastern upland, produce a large proportion of the crops grown in that section. The remaining soils, which are too stony or rough for cultivation, are in forest or are used as pasture.

The soils of the Gloucester series have brown surface soils and yellowish-brown or yellow subsoils which grade into gray unweathered till. The subsoils are usually of the same or lighter texture than the surface soils. These soils represent comparatively shallow deposits of glacial till derived mainly from gray granites and gneisses. They contain more or less rounded rocks and bowlders.

The principal difference between the Essex and the Gloucester soils is that the substratum below a depth of about 2 feet is highly compact in the Essex soils. This compaction does not prevent the movement of water but retards it to a great extent so that during wet seasons water moves along the surface of the substratum. The compact substratum causes this soil to be a normal-season soil, as it produces good crops only in seasons of normal rainfall. In wet seasons crops are drowned, and in extremely dry seasons, as the storage basin is shallow, the surplus water is readily exhausted. Roots, except the taproots of some trees, have difficulty in penetrating the compact layer and are thus cut off from the moisture supply.

The soils of the Whitman series have dark-brown or almost black mucky surface soils underlain by gray or yellowish-gray subsoils which are mottled with rust-brown and drab spots. The substratum is drab partly weathered till. These soils occur in poorly drained areas. They are derived mainly from granites, gneisses, and other crystalline rocks. Stone bowlders and fragments occur on the surface and embedded in the soil.

Gloucester loam.—Gloucester loam is the most important agricultural soil of the eastern upland. It has a dark-brown mellow surface soil to plow depth, passing into yellowish-brown fine friable loam which becomes paler with depth, and grades at a depth of 2 feet into gray slightly firm but not compact light-textured till. This soil carries a noticeable amount of granitic bowlders and is well drained and aerated. The structure of the subsoil is such that roots penetrate it with ease. The moisture-holding capacity is sufficiently good that crops do not suffer in moderately dry seasons, and it is slightly better than in the lighter-textured Gloucester soils. The surface is

hilly, but the hills are smoothly rounded with gently sloping sides. Although many of the stones have been removed and piled in fences, they are the chief impediment to cultivation of this soil. Hay, pasture, fruit, corn, potatoes, and vegetables, ranking in acreage in the order named, are the crops grown. As only a comparatively small proportion of the total acreage of crops in the county is grown on the eastern upland, the acreage on this one soil, which is the most extensive on the eastern upland, is necessarily small. About 70 per cent of the land is cleared and used for crops and pasture.

Crop yields on this land compare favorably with those on the remainder of the upland and compare well with those on any of the soils of the county. Hay yields from 1 to 2½ tons, corn silage from 10 to 15 tons, and corn for grain from 40 to 60 bushels an acre. Wheat and oats make fairly good yields, clover makes a good stand where limed, apple trees make a healthy growth and fruit heavily, and grass forms a good sod, particularly where bluegrass is seeded. This soil, like most of the soils in the county, is strongly acid, and although this condition does not seem to be detrimental in the production of most crops, legumes can not be grown successfully without the use of lime. When lime is used, and this is not often, about 1 ton an acre is applied.

Gloucester stony loam.—Gloucester stony loam is used to a very small extent for crop production aside from grass as pasture, and a very small area is in mowing. This soil differs from Gloucester loam only in the content of stone. The yields are about the same on both soils. The surface relief and drainage differ little from that of the loam.

Gloucester fine sandy loam.—Gloucester fine sandy loam is used for the same crops as Gloucester loam. Being a soil of lighter texture and naturally less productive, the yields range more widely than on the loam and are usually lower. Crop yields on the fine sandy loam depend more on the season, as the soil is inclined to be leachy and crops suffer from droughts more readily than on the loam. Good yields are more dependent on fertilizer practices and methods of treatment. This is an excellent fruit soil, and, although the yields are not so heavy as on the loam, the fruit is of excellent quality.

Gloucester stony fine sandy loam.—Gloucester stony fine sandy loam has a rougher surface relief than the other Gloucester soils, and drainage is thoroughly established. The Gloucester soils in general are developed over shallow till, but the stony fine sandy loam is shallower than the other types. Bedrock comes within 3 feet of the surface in places and is in few places deeper than 4 or 5 feet below the surface. This soil is little used for agriculture, possibly less than 15 per cent being cleared and used for farming, and most of this is in pasture, with some small areas in mowing and small patches of the crops commonly grown on the Gloucester soils.

Essex loam.—Essex loam is used to a small extent for cultivated crops but for the most part is in mowing and pasture. During a normal season, the yields of grass are about the same as on Gloucester loam, but they do not average so high over a period of years. The soil is not adapted to so wide a range of crops as is Gloucester loam. The compact substratum of some fine sandy loam areas, which are included with the loam in mapping, lies slightly deeper,

and here plant roots have a slightly deeper range. This included soil is not quite so productive naturally, that is, it does not contain so much plant food as the loam, but the texture and structure counterbalance this defect, and a wide range of crops can be grown to slightly better advantage.

Essex loam, stony phase. —Essex loam, stony phase, is used for pasture or is in forest. The only difference between this soil and typical Essex loam, is the high content of stone in the phase.

Whitman stony loam.—Whitman stony loam covers a small area of low poorly drained upland, which is known as stony meadow. It is for the most part in woods or brush pastures. The total area is small. Much of this soil is in the eastern upland, but some areas are west of the valley.

MISCELLANEOUS SOILS

Meadow.—Meadow occurs mainly on the overflow land along the smaller streams. It has a dark mellow surface soil, which is mucky in places, a mottled gray, rust-brown, and yellow subsoil, and a bluish-gray substratum. The texture ranges from loam to sandy loam. This land occupies positions subject to overflow and is imperfectly or poorly drained. Meadow is used for mowing and pasture. Much of the land is covered with small trees and shrubs.

Muck.—Muck consists of fairly well disintegrated organic matter and soil material. Most of it is 18 or 20 inches deep, but in a few places it is more than 5 feet deep. This material occurs along small stream bottoms and shallow filled-in lakes in the lower parts of the county. Where cleared, the land supports a wild grass that is sometimes cut for hay; but only small areas are utilized, even in this way.

Peat.—Peat represents a deeper deposit than muck, in which the organic material is more fibrous and in which there is comparatively little mineral matter. It occurs at higher elevations than muck, in filled-in lakes. The land is forested and not used for farming.

Rough stony land.—Rough stony land is very extensive in both the eastern upland and the western highland. It includes some land that is used for grazing, but by far the greater part is not suited to agriculture. Practically all of it is covered with forest and can best be used for this purpose.

SOILS AND THEIR INTERPRETATION

Except the higher parts of the western highland, where the true podzol soils of the north are developed, the soils of Franklin County fall within the region where the brown forest soils of the North Atlantic States are developed. These soils have developed under climatic conditions which allow an accumulation of some organic matter on the surface, not so much as in the podzol soils of the North but much more than in the soils of the Southern States. Although weathering influences have extended to a depth ranging from 2½ to 3 feet, there has been little leaching, or eluviation, a process so noticeable in the soils of the South.

A comparison of the mechanical analyses of typical soils of Massachusetts and North Carolina, given in Table 9, shows the differences in the soils of the two regions.

TABLE 9.—*Mechanical analyses of three soils of Massachusetts and two soils of North Carolina*

Source and soil type	Depth	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
Massachusetts:	*Inches*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Bernardston silt loam	0–8	3.3	7.8	4.8	17.3	24.8	29.9	12.8
	8–15	5.0	7.6	4.6	18.0	24.2	33.1	7.9
	15–24	4.0	6.4	3.8	18.3	24.8	33.2	10.0
	24–36	7.0	10.9	6.2	25.2	22.4	22.8	6.2
Merrimac loamy coarse sand	0–4	13.2	37.0	13.0	18.4	4.5	8.4	6.2
	4–6	18.6	36.5	11.6	16.4	5.1	7.6	4.8
	6–20	20.3	38.9	12.0	15.0	3.8	7.0	3.4
	20–36	30.1	35.4	11.5	16.0	2.6	3.5	1.3
Gloucester loam	0–7	3.8	15.9	9.0	24.4	14.7	24.4	7.8
	7–20	2.0	9.5	5.6	21.2	19.4	33.3	9.0
	20–30	1.5	6.3	4.2	22.6	29.3	31.8	4.3
	30–36	8.2	17.5	9.8	37.3	15.9	9.1	2.1
North Carolina:								
Porters fine sandy loam	0–4	2.7	13.2	8.9	33.1	13.9	19.7	8.7
	4–14	3.9	9.7	6.5	30.1	16.0	20.5	13.8
	14–48	2.2	6.4	4.4	23.7	11.8	8.4	43.4
	48–60	4.8	11.5	7.1	32.5	15.2	22.9	6.4
	60–72	13.2	16.6	8.8	33.2	12.1	14.5	1.6
Cecil fine sandy loam	0–5	4.8	12.4	7.8	27.2	9.8	22.9	15.6
	5–36	2.8	4.6	2.8	11.7	5.5	21.4	51.2
	36–72	1.3	9.6	8.4	25.6	12.5	16.9	26.1
	72–96	1.8	12.7	11.7	37.7	8.0	14.2	14.2
	96–112	7.9	19.3	12.7	39.9	8.6	9.7	2.2

The soils developed in North Carolina show strong eluviation from the surface, or A, horizon and an accumulation of the fine material in the B horizon.

A comparison of the chemical analyses of the two typical soils from each of the regions, given in Table 10, shows the effect of the climatic conditions under which the soils were developed.

TABLE 10.—*Chemical analyses of samples of two soils from Massachusetts and two s*

GLOUCESTER STONY FINE SANDY LOAM,[1] BERKSHIRE COUNTY, M

Sample No.	Depth	SiO_2	TiO_2	Fe_2O_3	Al_2O_3	MnO	CaO	MgO	K_2O	Na_2O	P_2O_5
	Inches	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per ce*
1307136	0–3	65.91	0.66	3.82	8.97	0.112	1.18	0.77	2.50	1.34	0.1
1307137	3–5	72.86	.68	3.91	1[illegible].53	.093	.91	.54	2.33	1.37	.1
1307138	5–15	74.79	.72	3.32	11.09	.060	1.11	.85	2.60	1.14	.1
1307139	15–24	74.13	.80	4.12	11.15	.070	1.52	.96	2.64	1.38	.1
1307140	24–36	76.03	.54	2.80	10.76	.050	2.54	.84	2.29	2.40	.2
BECKET LOAM,[2] BERKSHIRE COUNTY, MASS.											
35887	0–6	52.95	0.66	1.08	7.04	0.015	0.90	0.15	2.06	0.40	0.1
35888	6–11	83.32	.90	1.69	6.73	.014	.54	.18	2.89	.46	.0
35889	11–13	69.60	.79	3.99	9.61	.016	.65	.33	3.41	.46	.0
35890	13–24	72.67	.70	3.58	10.32	.02	.62	.41	3.45	.67	.0
35891	24–36	77.86	.53	3.15	10 00	.03	.54	.48	3.79	.55	.0
PORTERS LOAM,[3] RUTHERFORD COUNTY, N. C.											
236524	0–2	71.59	0.39	1.79	11.57	0.021	0.20	0.09	3.82	0.84	0.0
236525	2–10	72.17	.45	2.61	14.68	.023	.16	.13	3.94	.74	.0
236526	10–36	60.83	.56	4.48	22.25	.051	(4)	.78	2.54	.35	.0
236527	36–54	65.46	.52	3.97	19.37	.058	(4)	.53	4.26	.44	.0
236528	54+	68.57	.46	3.21	17.35	.084	.09	.59	4.93	.62	(4)
CECIL FINE SANDY LOAM,[2] YADKIN COUNTY, N. C.											
236902	1–4	86.62	0.49	1.45	5.71	0.013	(4)	0.18	2.01	1.40	0.0
236903	4–7	87.64	.59	1.36	5.55	.013	(4)	.17	2.10	1.42	.0
236904	7–10	72.92	.75	3.80	13.73	.013	(4)	.32	2.02	1.55	.0
236905	10–14	66.07	.96	5.91	17.59	.013	(4)	.19	1.02	.78	.1
236906	14–40	34.24	1.31	11.18	35.42	.013	(4)	.17	.62	.73	.1
236907	40+	49.62	.80	8.43	27.45	.020	(4)	.63	2.08	1.04	.0

[1] Analysts: G. Edgington and G. J. Hough. [2] Analyst: G. J. Hough. [3] Analyst: G

A description of a profile of Gloucester fine sandy loam, which is fairly representative of the gray-brown forest soils, in which the gray layer is absent, and is characteristic of the general soil profile of the region, follows: The A horizon consists of a 1-inch layer of dark-brown leaf mold resting on dark-brown mellow fine sandy loam which becomes light brown below a depth of about 2 inches. At a depth of 5 or 6 inches below the surface a bright yellowish-brown slightly firm but friable B horizon is reached, which grades downward into yellowish-brown and pale-yellow material, becoming lighter in texture below a depth of 20 inches, and grading at a depth ranging from 24 to 30 inches into gray rather loose unweathered till. The entire soil profile contains fragments and bowlders of the parent granitic material.

The soils of the western highland, which lie at an elevation ranging from 1,300 to 1,400 feet above sea level, are podzols, having the gray A horizon which characterizes the soils of the North. This layer ranges from 2 inches in thickness to a thin layer and in places is entirely missing. It is more pronouncedly developed in the lighter-textured soils. The podzol soils are developed under conditions of cold and moisture that favor the accumulation of organic matter on the surface and are better developed in soils of light texture where the downward movement of water is accelerated. These soils are the result of the action of the organic acids from the duff, or organic layer, on the surface, in removing the iron from the surface layer as it passes downward and depositing it in the upper part of the B horizon. The B_1 horizon is a very dark brown layer of about the same thickness as the surface soil. It is mellow or fluffy in most places and is not at all indurated. This material grades imperceptibly into the yellowish-brown B_2 horizon, typical of the rest of the soils in this region, but as a rule the depth to the C horizon, or parent material, is slightly less.

The upland soils of this region are weathered from glacial material which derives many of its characteristics from the parent rock from which it is derived. The soils of the eastern upland derived from granitic material are mainly Gloucester soils which are characterized by the large amount of granitic bowlders carried on the surface and throughout the entire soil mass. The substratum, or C horizon, is in most places only slightly firm and nowhere compact.

Most of the soils of the western upland and foothill region are derived from schist, and most of them have a compact substratum. A strong limestone influence is given the soils in the eastern part of this region by the Conway schist formation, which consists of alternating beds of soft schist and limestone. Not only was this formation more readily broken down by glacial action, but the surface soil was stripped from large areas and the débris piled into deep till areas. The weathering agencies have succeeded in breaking down this softer material more readily than the harder granitic material.

Bernardston loam is a typical example of a soil derived from this softer material (Leyden argillite), and shows the following profile: The surface layer consists of about 1 inch of leaf mold and forest débris overlying dark yellowish-brown loam which extends to a depth of 3 or 4 inches, where it grades into brown or yellowish-brown loam which is firm and has a crumb structure. This passes at a depth of

8 or 10 inches into grayish-brown rather heavy loam which becomes dark gray below a depth of 12 or 15 inches. This layer is fairly heavy but not compact. Below a depth of 24 inches the C horizon is reached. This consists of somewhat compact heavy greenish-gray till containing numerous small platy fragments of dark-colored slate.

The Essex soils are weathered from glacial till which, although derived from the same material (granitic) as the Gloucester soils, consisted of compact beds of till. The two soils are similar in the A and B horizons, but the C horizon of the Essex soils is compact in place and vesicular in structure, although when broken down it is apparently the same material as the C horizon of Gloucester loam.

The pH values of different layers of Gloucester loam are as follows: From 0 to 2 inches, 4.10; from 2 to 6 inches, 4.40; from 6 to 18 inches, 5.05; from 15 to 24 inches, 5.85; and from 24 to 36 inches, 6.

In the western foothills the soils are divided into two main groups—those having a loose substratum and those having a compact substratum. These groups are further divided into soils influenced by limestone and those having no lime influence. The soils influenced by limestone predominate. The Shelburne soils represent soils with a compact C horizon and limestone influence, and the Colrain soils represent those having limestone influence and a firm but not compact C horizon. Colrain fine sandy loam has a light layer of fine leaves on the surface and a dark-brown or brown fine sandy loam surface soil mixed with organic matter. This passes at a depth of 4 or 5 inches into yellowish-brown loam of single-grain structure, which becomes mealy pale yellowish-brown fine sandy loam with a green tint below a depth of 20 inches. At a depth ranging from 24 to 30 inches, the C horizon of greenish-yellow or olive-colored till is reached. The till is firm in place but not compact, and it contains numerous fragments of the parent rock. Spots of dark-brown porous material, which represent limestone from which the carbonates have been removed or are in the course of removal, occur in this layer. Numerous limestone bowlders occur on the surface.

The pH values of different layers of Colrain fine sandy loam are as follows: From 0 to 5 inches, 5.22; from 5 to 10 inches, 5.55; from 10 to 20 inches, 5.20; from 20 to 30 inches, 6.47; from 30 to 68 inches, 5.47; and at 2 feet, 6.82.

The Shelburne soils differ from the Colrain soils in that they are weathered from deeper, more tightly compact material. The C horizon is decidedly compact or cemented, and, although not a true hardpan, prevents deep root penetration and downward movement of excess water. The structure is platy and vesicular and the color is olive yellow or greenish yellow. As in the Colrain soils these soils also contain dark spots of rotted limestone and limestone bowlders on the surface and throughout the entire solum and substratum.

The pH values of different layers of Shelburne loam are as follows: From 0 to 2 inches, 5.05; from 2 to 10 inches, 5.39; from 10 to 18 inches, 5.89; from 18 to 24 inches, 6.07; and from 24 to 48 inches, 6.32.

The Buckland soils at the base of the western highland have a compact substratum, or C horizon, but not so compact as that of the Shelburne soils. They contain an admixture of slate that results in a heavier-textured C horizon and a greenish-gray color.

The pH values of different layers of Buckland loam are as follows: From 0 to 1 inch, 4.37; from 1 to 4 inches, 4.43; from 4 to 12 inches, 4.69; from 12 to 24 inches, 5.05; and from 24 to 36 inches, 5.47.

The Woodbridge soils are the counterpart in color and structure of the Shelburne soils, but they show no limestone influence.

The pH values of different layers of Woodbridge loam follow: From 0 to 1 inch, 3.96; from 1 to 5 inches, 4.79; from 5 to 15 inches, 4.85; from 15 to 25 inches, 5.00; and from 25 to 36 inches, 5.19.

The Hollis soils are derived from schist with no limestone influence, and they correspond to the Colrain soils. They have weathered from shallow till.

The Worthington and Berkshire soils are the outstanding soils in the western highland. The Worthington soils are developed on the flattened ridge tops of the eastern part of the highland. They are weathered from glacial beds that were derived from dark graphitic schist and some interbedded impure limestone. The till is weathered to a comparatively slight depth.

Worthington loam is faintly podzolic in places, having a dark-brown surface covering of 1 or 1½ inches of raw humus, or duff, over gray or purplish-gray loam or fine sandy loam from one-half to 1 inch thick, which passes rather abruptly into deep-brown or rust yellowish-brown loam and this, in turn, at a depth of 5 or 6 inches below the surface, grades into greenish-yellow heavy loam having a crumb structure. At a depth ranging from 20 to 24 inches, the C horizon of compact greenish-gray or olive-colored till is reached. The material in this horizon has a somewhat platy breakage and a vesicular structure. The soil mass contains very little stone. The pH values of different layers of Worthington loam are as follows: From 0 to 1 inch, 4.13; from 1 to 2 inches, 4.13; from 2 to 5 inches, 4.37; from 5 to 24 inches, 4.75; and from 24 to 48 inches, 5.22.

The Blandford soils have profiles similar to the profiles of the Worthington soils, but the Blandford soils are not quite so dark. They are developed on the ridges farther west than those occupied by the Worthington soils and are outside the zone of limestone influence. They contain little stone, as they are derived from soft schist which broke down under glacial action.

The Berkshire soils are developed on hillsides and broken ridges of the western highland. The profile of Berkshire fine sandy loam is representative of the soils of this series. This soil consists of a 1 or 1½ inch surface layer of dark-brown leaf mold, or duff, resting on a gray or purplish-gray medium fine sandy loam layer, 2 or 3 inches thick, which grades rather abruptly into very dark brown fine sandy loam, and this, in turn, changes within a depth of a few inches into deep-brown or yellowish-brown firm but friable fine sandy loam having a crumb structure. The material in this horizon retains its strong color to a depth of about 20 inches where it changes to pale greenish yellow. Here the material is rather light textured and fluffy. Below this the material passes gradually into the parent material which is olive yellow or greenish yellow, and, although compact, is light in texture when broken down. The structure of this horizon, which extends to a depth of 20 feet or deeper, is somewhat platy and is vesicular or small tubular. The soils on the flatter ridge tops, particularly those derived from the darker graphitic schist, are weathered less deeply than is general for the soils of this region.

The pH values of samples of Berkshire fine sandy loam taken at different depths are as follows: From 0 to 1 inch, 4.50; from 1 to 2½ inches, 4.22; from 2½ to 6 inches, 4.55; from 6 to 9 inches, 4.62; from 9 to 24 inches, 4.83; and from 24 to 36 inches, 5.32.

The Becket soils are similar to the Berkshire soils, except that the brown color extends deeper, and the material of the C horizon is more lightly cemented and is also lighter in texture when broken down. These soils are derived from granitic material and contain a large quantity of stone. They are developed on ridge tops and hillsides, the less stony types, the fine sandy loam and the loam, occurring on the ridge tops.

Small spots of imperfectly drained soil in all parts of the upland, but more highly developed over the western highland, have been correlated as Peru loam. This soil has a dark-brown surface soil, and a B horizon which is brown in the upper part and mottled in the lower part with brown, yellow, and gray. At a depth ranging from 15 to 24 inches, is a compact substratum which is more or less impervious to the downward movement of water. This soil carries a noticeable quantity of stone

The soils of the Connecticut Valley were weathered from material accumulated by glacial outwash along the old stream valley and on the glacial lake beds. In general these deposits are light textured, particularly those deposited by rapidly moving currents in the smaller stream valleys and along the edges of the glacial lakes where the first load of material was deposited. In the middle of the larger lakes, like the so-called "Connecticut Lake," the material is fine, consisting in places of clay beds. Owing to the light texture of these deposits, weathering influences have penetrated to a greater depth than is general for the soils of this region. The quartz gravel, however, has resisted weathering and remains in the upper horizons. These soils show a greater effect of eluviation than the soils of the upland or the soils of the Connecticut River Valley, which are young and have weakly developed profiles.

The soils developed on the old terraces show little tendency to accumulate organic matter and in this respect are more closely related to the soils of the northern part of the Atlantic coastal plain.

The soils of the Merrimac series are developed on terraces that lie at an elevation ranging from 100 to 200 feet above the level of the Connecticut River, but they do not represent terraces formed by the present stream. The material is of glacial-outwash origin. Although the fine sandy loam and sandy loam are fairly extensive, Merrimac loamy sand is probably the most representative type of the series and is fairly typical of the soils developed on the old terraces. The A horizon consists of a one-half to 1 inch layer of dark organic matter mixed with quartz sand grains, underlain by brown loamy sand or sand slightly darkened by organic matter and having a single-grain structure. This changes, at an average depth of 5 inches, into the B horizon which consists of yellowish-brown slightly firm loamy sand containing some gravel below a depth of 15 or 20 inches and grading at a depth of 20 inches into yellow loamy sand which is fairly loose and open in structure. Below a depth ranging from 30 to 36 inches this material passes into gray sand containing some gravel, in places tarnished with yellow. Below a depth of 4 or 5 feet the material consists of stratified sand and gravel, mainly quartz and granite, which

is loose and incoherent in structure. The Merrimac soils in the northern part of the valley are derived mainly from argillite. The parent materials of the Merrimac soils in general are derived from granitic and other crystalline rocks.

The pH values of samples of Merrimac fine sandy loam taken at different depths are as follows: From 0 to 1 inch, 4.33; from 1 to 5 inches, 4.53; from 5 to 15 inches, 5.42; from 15 to 25 inches, 5.57; and from 25 to 36 inches, 5.89.

Table 11 gives the results of mechanical analyses of samples of the surface soil, subsurface soil, and subsoil of Merrimac loamy sand.

TABLE 11.—*Mechanical analyses of Merrimac loamy sand*

No	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
30475	Surface soil, 0 to 6 inches	3.8	12.4	10.0	47.3	9.0	10.4	7.0
30476	Subsurface soil, 7 to 20 inches	1.8	11.6	10.8	54.3	7.2	10.7	3.8
30477	Subsoil, 21 to 30 inches	6.7	23.6	13.6	34.6	7.2	12.1	2.3
30478	Subsoil, 31 to 40 inches	23.0	35.2	9.1	19.2	3.8	7.6	2.1

The Enfield soils are associated with the Merrimac soils. They consist of sandy material similar to that of the Merrimac soils laid down on till derived from Triassic material which lies at a depth ranging from 20 to 36 inches below the surface.

The Merrimac and Enfield soils have developed on the terraces and have level or smooth surface relief. Soils associated with them but developed on deposits having a hummocky surface relief are correlated in the Hinckley and Manchester series. The Hinckley soils have profiles similar to the Merrimac soils, but in general, particularly in the gravelly types, they carry more gravel and more small rounded bowlders. Hinckley loamy sand carries little gravel and is similar in profile to Merrimac loamy sand. The Manchester soils have the same general surface relief and profile arrangement as the Hinckley soils but are derived from Triassic material, whereas the Hinckley soils are derived from granitic and other crystalline rocks. Because of the broken surface relief and the loose and open substratum, these soils are extremely leachy.

The Windsor soils have similar surface relief to the Hinckley soils but are derived from wind-blown material. They have developed a profile similar to that of the Hinckley soils. Although this material does not show true stratification the strata are well marked and are separated by thin layers, probably representing material laid down during the interstorm period.

The hill land through the valley, which was formed by glacial till derived from Triassic sandstones and conglomerates, is occupied by the Cheshire soils. These soils are predominantly fine sandy loam and sandy loam, and in places they carry much gravel. Although in spots the depth to bedrock is slight, these soils contain only a comparatively small amount of stone as compared with the Gloucester soils and many other soils of the upland. Cheshire fine sandy loam is the predominant soil of the Cheshire series. It has a dark-brown mellow surface soil about 3 inches deep, with a comparatively small amount of forest leaf accumulation on the surface. Between depths

of 3 and 12 inches the B horizon is yellowish-brown mellow fine sandy loam with a reddish-brown cast. This grades rather imperceptibly into a lighter yellowish-brown or reddish-brown firm but not compact fine sandy loam which changes at a depth of about 24 inches into reddish-brown firm sandy till. The entire profile contains some chips of red sandstone and, in places, some quartz gravel or fragments from the arkose conglomerate.

The pH values of samples of Cheshire fine sandy loam taken at different depths are as follows: From 0 to 3 inches, 4.67; from 3 to 12 inches, 4.52; from 12 to 24 inches, 5.02; and from 24 to 36 inches, 5.35.

The surface soil of Cheshire sandy loam is brown, the B horizon ranges from brown to yellowish brown but is not quite so red as the fine sandy loam, and the C horizon has more of a pink cast. Cheshire sandy loam is derived mainly from the arkose conglomerate and carries more stone than the fine sandy loam. The surface relief of both soils is gently rolling or sloping, and drainage is well established. The red in these soils is caused by the color of the parent rock material, and the paler colors of the upper horizons are probably owing to the reduction of the iron content.

Several soils are developed on the heavier deposits of the old terraces or are influenced by the clay deposits in the substrata. Suffield loam is the most important of these soils, as the clay bed comes within 3 feet of the surface. The surface soil, or A horizon, is dark-brown fine sandy loam or loam, in which about an inch of the surface material is slightly darker in color. The B horizon, which is reached at a depth of 5 or 6 inches, consists of pale brownish-yellow crumbly loam, which, although becoming paler brown and slightly heavier below a depth of 18 or 20 inches, maintains the same structure as the material above. The C horizon is reached at an average depth of 2 feet, but the range in depth is slight, from 1½ to 2½ feet. This layer consists of brownish-gray silty clay loam, with a green cast, which, at a depth of 4 or 5 feet and in some places less, gradually becomes laminated. Beneath this are greenish-gray clay beds showing brown streaks along the bedded planes and in places containing some fine or very fine sandy loam strata. The material in the lower part of the C horizon is alkaline in reaction, although the material of the solum is acid.

Melrose fine sandy loam is the only soil of the Melrose series mapped in Franklin County. Its profile resembles the profile of the Merrimac soils with the following exceptions: The A horizon is slightly darker, the material carries no gravel, and the C horizon is faintly mottled with brown and gray below a depth of 20 or 24 inches. In most places the C horizon is very sandy. Because of the clay bed underlying this soil at a depth ranging from 36 to 60 inches below the surface, and because of the level surface relief of the terraces on which it is developed, underdrainage is retarded to some extent. Aeration is not so good as that of the Merrimac soils. The entire soil profile shows an acid reaction.

The soil developed on the interior flats of the terraces is correlated as Scarboro loam. The profile of this soil is similar to that of the Melrose soil, except that the A horizon of the Scarboro loam is much darker as it contains a high percentage of organic matter. This dark horizon is much thicker than the corresponding horizon of the Melrose soil. The mottling in the C horizon is more intense in some places

than in the C horizon of the Melrose soil, and in other places the material of the C horizon is drab gray or greenish gray. The clay strata are usually at a slightly greater depth, but the Scarboro loam lies lower than the Melrose soil and drainage is poor. The material of the entire profile is strongly acid.

The soils of the Connecticut River Valley, which are developed on the terraces and flood plain of the stream and to less extent on the terraces of Deerfield and Green Rivers, are young alluvial soils showing weakly developed profiles. The soils on the higher terraces, which range from 50 to 100 feet above the present stream level and from 20 to 80 feet above overflow, belong to the Agawam series. These soils are developed on fairly level terraces, and, owing to the sandy character of the substratum, drainage is good. Although the profile development is not so pronounced as in the Merrimac soils, it has reached a more advanced stage than that of the Hadley soils which are developed on the lower terraces and overflow land.

Agawam fine sandy loam is the most extensive and the most representative soil of the series. It has a dark-brown fine sandy loam surface layer, 2 or 3 inches thick, resting on light-brown mellow fine sandy loam which changes at a depth of 8 or 10 inches into the B horizon of light yellowish-brown fine sandy loam having a floury structure. The material in this layer becomes paler and changes at a depth ranging from 24 to 30 inches to greenish-gray micaceous loamy very fine sand. Below a depth ranging from 36 to 40 inches the substratum is gray micaceous bedded fine sand and very fine sand which extends to a depth of 5 or more feet.

Agawam loamy fine sand has a profile similar to the other Agawam soils, but its development is more pronounced, the oxidation being slightly stronger and extending to a depth of about 36 inches. The surface relief of this soil is more undulating than that of the fine sandy loam, and drainage is more thoroughly established.

The soils developed on the lower terraces belong to the Hadley series. The main soils of the Connecticut River Valley lie above normal overflow, but parts of them, at least, are subject to occasional slight inundations. The overflow phases of these soils are covered each spring by flood waters and receive some deposits. The deposits from the streams of this region are usually not large, but during excessive floods sand and rubbish are deposited on the lower bottoms.

Hadley very fine sandy loam is fairly representative of the soils of the Hadley series that lie above normal overflow. The surface soil consists of dark-brown very fine sandy loam, 3 inches thick, which grades into brown mellow very fine sandy loam extending to a depth of 6 or 8 inches. This passes into the B horizon of light-brown floury very fine sandy loam which becomes slightly lighter brown in color and grades, at a depth of 18 or 20 inches, into greenish-yellow or olive-colored floury very fine sandy loam. The C horizon consists of greenish-gray loamy very fine sand below a depth ranging from 30 to 36 inches. The surface relief of the low terraces is level, with slight swells extending in the same direction as the current of the main stream. Many of these swells are occupied by Hadley loamy very fine sand which becomes slightly grayer with depth and carries more fine dark mica fragments. Hadley silt loam occupies lower levels and back-bottom positions where both drainage and aeration are less perfect than over the other Hadley soils. Hadley silt loam has a stronger

olive color throughout the lower horizons than the very fine sandy loam. The overflow phase of the silt loam contains spots which are imperfectly drained. The soil in these spots has a grayish-brown A horizon to a depth of 6 inches and is greenish gray below, and the material of the entire profile is extremely floury.

The pH values of samples of Hadley very fine sandy loam taken at different depths are as follows: From 0 to 6 inches, 4.72; from 6 to 12 inches, 4.72; from 12 to 20 inches, 5.02; from 20 to 30 inches, 5.70; and from 30 to 36 inches, 5.50.

The Ondawa soils occupy most of the bottom land along the larger streams outside the Connecticut River Valley. The soil material throughout the profile is browner than that of the Hadley soils. Ondawa loamy sand, although the B horizon is yellowish brown, contains more gray color than Ondawa fine sandy loam. A few areas are of loamy fine sand texture, and the soil material in these areas is very yellow in the lower part of the B horizon.

Whitman stony loam is developed in low poorly drained spots throughout the upland, the better developments occurring over the eastern upland. This soil has a dark-brown mucky surface soil, extending to a depth of 6 or 8 inches, which grades into a mottled yellowish-brown, brown, and gray fine sandy loam firm but not compact B horizon, underlain by a gray light-textured noncompact C horizon. As the name implies this soil carries a large amount of stone.

Meadow occurs along the smaller stream valleys. The surface soil in areas of meadow is dark brown and contains much organic matter. It grades below into a mottled brown, yellowish-brown, and gray subsoil, passing at a depth of about 2 feet into a drab-gray substratum. The texture ranges between wide limits even in the same locality. Drainage is imperfect or poor. The tree growth consists mainly of willow, elm, soft maple, and alder, with an undergrowth of blueberries and huckleberries.

Muck occurs along poorly drained stream bottoms and in shallow filled-in lakes or sloughs. It consists of dark-brown or almost black finely divided organic matter and some mineral soil material and ranges from 15 inches to 4 feet in depth. The forest growth is similar to that on meadow. This soil occurs on the terraces and in the bottom land of the Connecticut River Valley in positions favorable for its development.

Peat consists of brown fibrous organic material to a depth ranging from 5 to 10 feet or deeper, and it occurs mainly in filled-in lakes scattered over the upland.

Rough stony land consists of land too rough or too stony for profitable farming. It occupies a large total area and is widely distributed over the county. The soil material differs with the rock association; in the eastern upland it is nearly all Gloucester fine sandy loam, and in the western highland it varies widely but Berkshire fine sandy loam is dominant in the western part of this region. The forest growth ranges between wide limits but contains much hemlock and rhododendron.

SUMMARY

Franklin County is in the northwestern part of Massachusetts. It includes an area of 691 square miles. The surface relief represents

a high plateau sloping southeastward, cut near the middle by a fairly broad but deeply incised valley. The region east of the valley is severely dissected, but the hills are smoothly rounded. Immediately west of the valley are the foothills, a severely broken area lying much lower than the western highland. The western highland is a high plateau with deep narrow V-shaped valleys and fairly broad flat-topped ridges. The valley, or lowland, consists of level bottom land and terraces interspersed with low hills.

The population is centered in the valley and in the foothills west of the valley.

The climate is humid, with a rather wide range between winter and summer temperatures, and there is also a wide difference between the climatic conditions in the valley and on the western highland. Many crops and varieties of crops will not mature or do not thrive in the higher elevations and necessarily are grown in the valley.

The soils of the county occur within the region where the brown forest soils are developed, although the true podzol soils of the North, having the gray layer, are developed only on elevations above 1,300 feet. The soils have weathered from glacial till and glacial outwash material and are strongly influenced by the basic rock material. The climatic conditions have been such that weathering has taken place to a comparatively slight depth (2½ feet), and eluviation has taken place to a very limited extent.

Hay, pasture, orchards, corn, tobacco, onions, potatoes, small grains, and vegetables, ranking in the order of acreage importance, are the principal crops grown. Tobacco, onions, and hay are the crops most important from a financial standpoint.

Although tobacco and onions have proved profitable in the past, the lessening demand for cigar tobacco is a serious threat to curtailment of the crop, and the competition in other low-cost areas is a menace to onion production. These crops are grown on the lighter-textured soils of the valley, the Merrimac, Agawam, and Hadley soils. All light-textured soils are used for tobacco and to a small extent for other crops. The Merrimac soils are suited to and can be used for growing potatoes, vegetables, and the staple crops used in conjunction with dairying. The Agawam and Hadley soils could, in case of a lessening demand for tobacco or onions, be used for a variety of crops which would support the dairy industry, also for market-garden crops. The soils of the valley, like most soils developed on the terraces of this region, are light in texture and require added plant food or successful crop production. They make an excellent medium in which to grow crops, as root penetration is easy, and the moisture-absorbing and moisture-holding capacity is, in general, fairly good.

A group of soils, the Suffield, Melrose, and Scarboro fine sandy loams and loams, developed in the central part of the valley, have a clay substratum at different depths below the surface. This retards underdrainage and helps conserve moisture, which is an advantage in crop production in dry seasons but a disadvantage in wet seasons.

The overflow soils of the Connecticut River Valley, represented by the overflow phases of the Hadley soil, are naturally more productive than the nonoverflow soils and far more productive than the Merrimac soils. Muck and peat are used for hay, corn, and pasture.

The hill soils within the bounds of the valley, derived from till of Triassic origin, belong to the Cheshire series. They are of fine sandy loam and sandy loam texture and contain little rock. They are suited to apples, peaches, and small fruits and can be used for dairy and chicken farms.

The soils of the foothills, mainly Shelburne loam and Colrain fine sandy loam, which are influenced by limestone, and Hollis fine sandy loam and Bernardston loam, which are noncalcareous, are used mainly for dairy farms and orchards. The stony members of the Hollis and Bernardston series are used for pasture.

Of the soils of the western highland, Worthington loam, which has some limestone influence, is the most important. Although dairying is engaged in only to a small extent, this is good grassland and capable of supporting a fairly extensive dairy industry. Berkshire loam and allied soils have no limestone influence and, although not so well suited to grass, are highly adapted to potatoes. The stony areas are suited to forestry and to less extent to pasture.

The soils of the eastern upland suited to farming are of very small extent. They are Gloucester loam, Gloucester fine sandy loam, Gloucester stony loam, Essex loam, and Essex loam, stony phase. These soils can be utilized for dairying and for growing apples, small fruits, potatoes, and vegetables. The stony areas are best suited to pasture. A large area of Gloucester stony fine sandy loam has a low agricultural value, and, together with much of the stony soils of the foothills, as the stony and shallow soils of the Hollis series and the stony soils of the Berkshire series, should be left in forest or allowed to grow up in forest. Where advantageously located they might be used for pasture.

Extensive areas of rough stony land occur in both the eastern upland and the western highland. This land should remain in forest.

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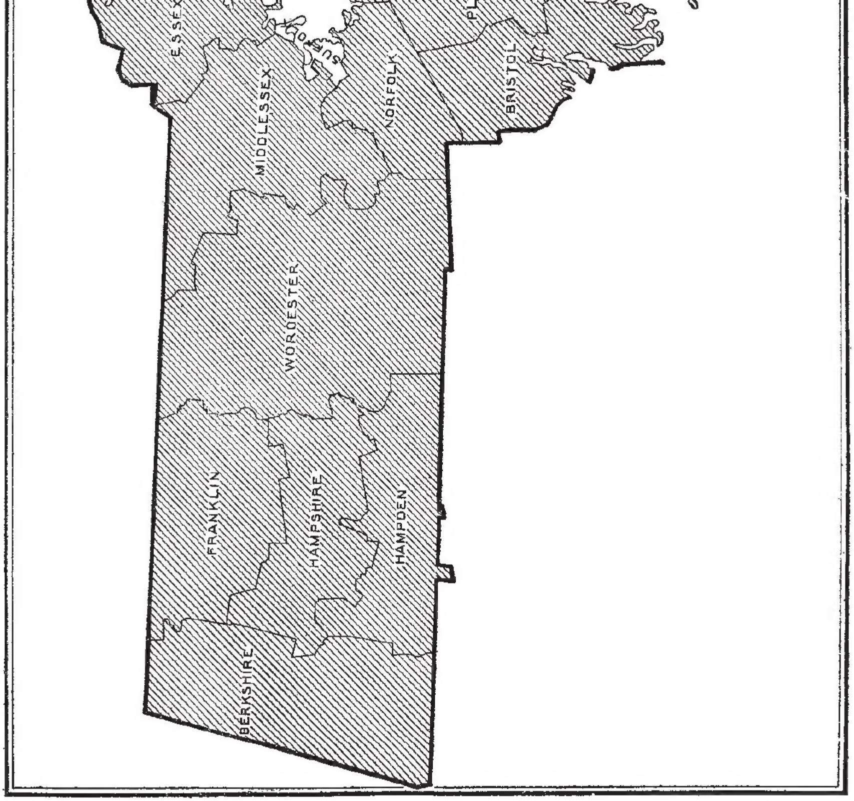

Areas surveyed in Massachusetts, shown by shading.

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SOIL MAP
FRANKLIN COUNTY
MASSACHUSETTS

MASSACHUSETTS DEPARTMENT OF AGRICULTURE
A. W. GILBERT, COMMISSIONER
DIVISION OF RECLAMATION, SOIL SURVEYS, AND FAIRS
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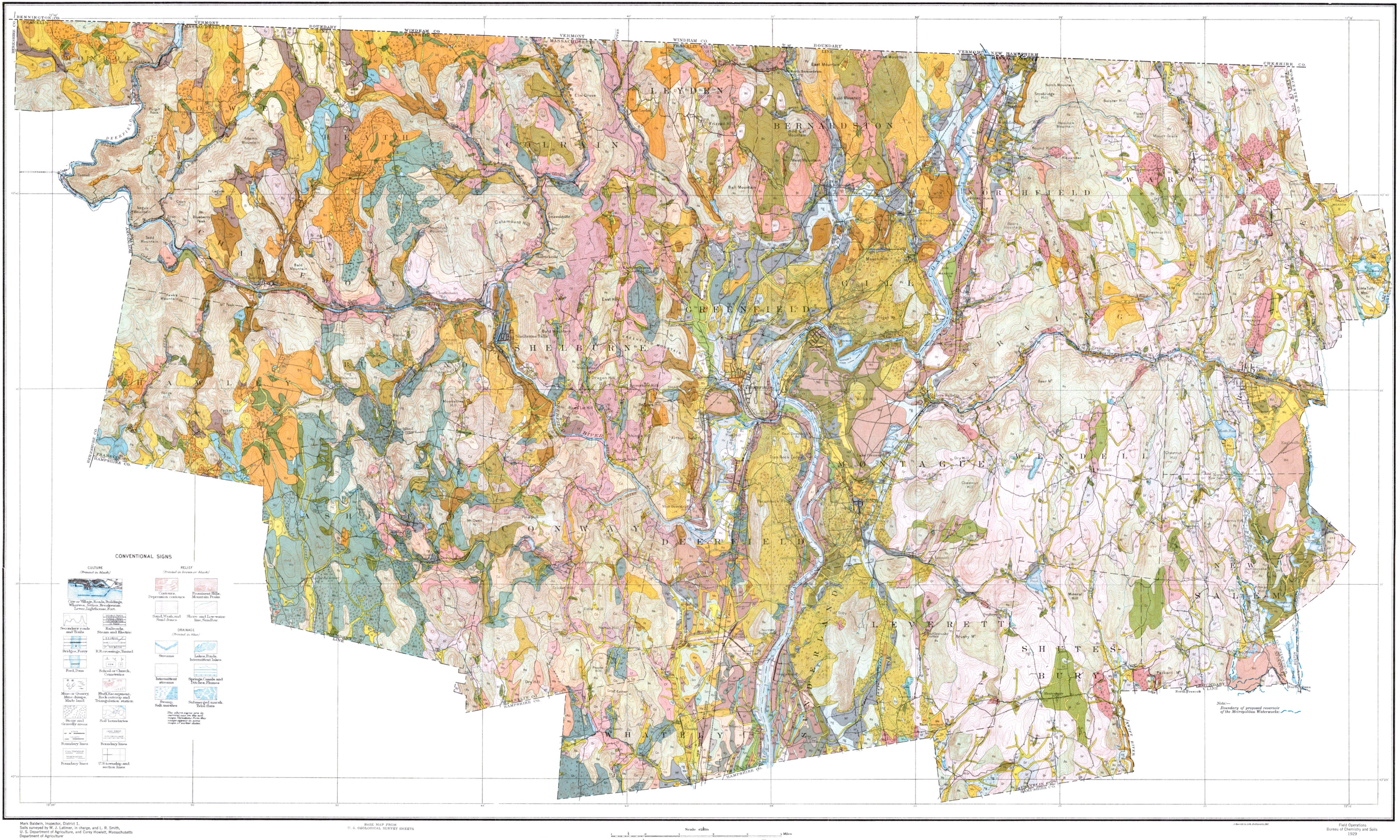

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

- City or Village, Roads, Buildings, Wharves, Settee, Breakwater, Levee, Lighthouse, Fort
- Secondary roads and Trails
- Railroads, Steam and Electric
- Bridges, Ferry
- R.R. crossings, Tunnel
- Ford, Dam
- School or Church, Cemeteries
- Mine or Quarry, Marl pit
- Bluff, Escarpment, Rock outcrop, and Triangulation station
- Stony and Gravelly areas
- Soil boundaries
- Boundary lines
- Boundary lines
- Township lines
- Boundary lines
- U.S. township and section lines

RELIEF
(Printed in brown or black)

- Contours: Depression contours
- Prominent Hills, Mountain Peaks
- Sand, Wash, and Sand dunes
- Shore and Low-water line, Sandbar

DRAINAGE
(Printed in blue)

- Streams
- Lakes, Ponds, Intermittent lakes
- Intermittent streams
- Springs, Canals and Ditches, Flumes
- Swamp, Salt marshes
- Submerged marsh, Tidal flats

The above signs are in current use on the soil maps; therefore from the maps of earlier dates.

LEGEND

Agawam loamy fine sand (Af)	Colrain fine sandy loam (Cf)	Manchester gravelly fine sandy loam (Mch)
Agawam fine sandy loam (Af)	Colrain fine sandy loam, Shallow phase (Cf)	Melrose fine sandy loam (Me)
Becket stony loam (Bp)	Colrain stony loam (Cs)	Merrimac loamy sand (Ms)
Becket loam (Bt)	Colrain loam (Cl)	Merrimac sandy loam (Ms)
Berkshire fine sandy loam (Bs)	Enfield fine sandy loam (Ef)	Merrimac fine sandy loam (Mf)
Berkshire stony loam (B)	Essex loam (E)	Ondawa loamy sand (O)
Berkshire loam (Bm)	Stony phase (E)	Ondawa fine sandy loam (Of)
Bernardston stony loam (Bs)	Gloucester stony fine sandy loam (Gr)	Penn loam (P)
Shallow phase (Bs)	Gloucester fine sandy loam (Gf)	Scarboro loam (Sm)
Bernardston loam (Bn)	Gloucester stony loam (G)	Shelburne loam (Sh)
Shallow phase (Bn)	Gloucester loam (Gl)	Stony phase (Sh)
Blandford loam (Bd)	Hadley loamy fine sand, Overflow phase (Hs)	Suffield fine sandy loam (Sf)
Shallow phase (Bd)	Hadley loamy very fine sand (Hv)	Steep phase (Sf)
Stony phase (Bd)	Hadley very fine sandy loam (Hv)	Whitman stony loam (W)
Buckland stony loam (Bk)	Hadley silt loam (Hs)	Windsor fine sand (Ws)
Buckland loam (Bc)	Hadley silt loam, Overflow phase (Hs)	Windsor loamy fine sand (Ws)
Shallow phase (Bc)	Hinckley loamy sand (Hs)	Woodbridge stony loam (Ws)
Cheshire sandy loam (Ch)	Hinckley gravelly sandy loam (Hg)	Woodbridge loam (W)
Cheshire fine sandy loam (Ch)	Hollis stony fine sandy loam (H)	Worthington loam (Wo)
Shallow phase (Ch)	Hollis stony fine sandy loam, Shallow phase (H)	Shallow phase (Wo)
Gravelly phase (Ch)	Hollis stony fine sandy loam, Shallow phase (H)	Stony phase (Wo)
Ostrolly stony fine sandy loam (Os)	Hollis fine sandy loam (H)	Muck (Mu)
Shallow phase (Os)	Muck, Shallow phase (Mu)	Peat (P)
Meadow (M)	Rough stony land (Rs)	

Mark Baldwin, Inspector, District 1.
Soils surveyed by W. J. Latimer, in charge, and L. R. Smith, U. S. Department of Agriculture, and Corey Howlett, Massachusetts Department of Agriculture

BASE MAP FROM
U. S. GEOLOGICAL SURVEY SHEETS

Scale 1:62,500
1 0 1 2 3 4 Miles
1 0 1 2 3 5 Kilometers
Contour interval 20 feet.
Datum is mean sea level.

Field Operations
Bureau of Chemistry and Soils
1929